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C. R. OSTEN SACKEN.

ON THE
OXEN-BORN BEES OF THE ANCIENTS
(BUGONIA)
AND THEIR RELATION TO
ERISTALIS TENAX
A TWO-WINGED INSECT.

ENLARGED EDITION OF THE ESSAY:
ON THE SO-CALLED BUGONIA OF THE ANCIENTS ETC. PUBLISHED IN THE
BULLET. SOC. ENT. ITAL. 1893.

HEIDELBERG.
J. HOERNING.
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PREFACE.

The Paper I published last year „On the so-called *Bugonia* of the ancients," in the *Bollettino della Società Entomologica Italiana* 1893, was presented by me to that Society on the occasion of the 25th anniversary of its existence. In preparing this Essay, I kept the purpose in view to make it readable, and for this reason, I omitted all tedious details, although their introduction would perhaps have strengthened my argument. In the present edition I enter into these details, and, at the same time, I improve the opportunity for correcting some errors that occurred in my first Paper, for answering some criticisms, and for introducing some new facts which have come to my knowledge, recently, on the same subject.

In the main portion of my present Paper I have preserved the distribution, and in most cases, the wording of my previous Essay. But I have added a Supplement, divided into paragraphs, each of them discussing a separate subject, and giving the necessary detail of proofs, arguments, answers to objections etc. on questions that had been only summarily treated in the body of the paper. Thus the ordinary reader will have the opportunity of comparatively light reading in the first part of the paper, and the more serious inquirer will find the detail in the second. With this distribution some repetitions were unavoidable, but I have found that, in discoursing on intricate subjects, like the one I have undertaken to unravel, repetition impresses the mind most effectually, and thus, becomes a useful form of rhetoric. For the same purpose of clearness, I have introduced very frequent references to previous paragraphs which, to some readers, may appear tedious, but which I considered useful. Each of the chapters of the Supplement treats of a single subject, and, by means of such references and repetitions, can be read and understood separately from the others.

My first Essay (1893) merely established the identity of the oxen-born bee of the ancients with the fly *Eristalis tenax*. This second edition shows progress in three principal points:

1°. It affords the proof that the processes, used by the ancients for what they called „making bees“ *(apes facere)*, preposterous as they appear, are very rational processes for obtaining the „oxen-born bee“ *(Eristalis tenax)*, but by no means the real honey-bee *(Apis mellifica)*.

2°. It gives, what I believe to be a plausible explanation of the apparent stolidity of the ancients in producing, for centuries, artificial „oxen-born bees“, without ever becoming aware that these so-called bees never gave them any honey (or any *money*, as the compositor made it appear in one of the proof-sheets).

3°. It shows that the *horse-born hornet* of the ancients *(Pressus humo bellator equus crabronis origo est,* Ovid. Met. XV, 368) is nothing but the common parasite of the horse, the gadfly, or botfly *(Gastrophilus equi)*.

Besides the natural explanation of the cause and origin of a superstition which has become historical, my investigation of the subject offers several collateral aspects of scientific interest:

1. It tells the tale of *E. tenax*, an insect which seems to have been „for man's confusion born“, passing unknown and unobserved for thousands of years, and causing a great amount of absurdity to grow wherever it appeared.

2. It proves, by the study of the wanderings of this insect over the globe, that Darwin was right when he said: „Now I maintain against all the world that no man knows anything about the transoceanic power of migration“ etc. (Life and Letters, II, p. 243, in a letter to J. D. Hooker). Comp. below, p. 32.

3. It illustrates, in the „Bugonia-craze“, an interesting episode in the history of science, and of the human mind in general, which proves how, to use an expression of Réaumur, „in the advancement of truth, anything may become an obstacle.“

In order to exhaust the story of the Bugonia, it would be necessary to collect *all* the passages, concerning it, which exist in ancient and modern literature. To undertake such a task, perhaps easy for a philologist, would for me be presumptuous. I have made use of such references in so far only as they were necessary for the illustration of my principal thesis: „Without *Eristalis,* no Bugonia“.

My interest in *Eristalis tenax* was aroused by the fact that, as a student of Dipterology, I happened to be the first to call attention to its sudden appearance in the United States, when, on November 5th 1875, I found a specimen on a window in Cambridge, Mass. Since then I have been watching its rapid progress in North America, and afterwards, its extraordinary invasion into New Zealand; in the mean time, quite naturally, I was drawn into an inquiry about its previous history.

The *Supplement* contains eleven chapters on the following subjects:

I. (p. 39). Analysis of the process of the ancients for breeding oxen-born bees.

II. (p. 47). The Bugonia from a psychological point of view.

III. (p. 49). On the gradual revival of Natural Science in the XVIIth and XVIIIth centuries; a chapter translated from Réaumur, Mém. etc. Vol. I, p. 28—31.

IV. (p. 52). The inconsistence of Redi in regard to the principle: *omne vivum ex ovo.*

V. (p. 53). Why the ancient writers, in so many passages concerning the Bugonia, derive the origin of *hornets* from carcases of horses, and often confuse them with *wasps.*

VI. (p. 55). The text of the fable of Lessing on the horse-born wasp, and that of the passage of Melanchthon about the Bugonia.

VII. (p. 57). Objections against my interpretation of the Bugonia of the ancients; with a paragraph on Samson's bees.

VIII. (p. 62). Professor Merx's article: „The Honey in the carcase of the Lion." (Translated from the German.)

IX. (p. 69). A new hypothesis about the origin of the Bugonia-superstition.

X. (p. 71). Notices on some of the authors whose works contain mention of the Bugonia and who have been quoted by Redi, as well as, in the present publication, with reference to Redi.

XI. (p. 76). Notice on Pastor Overbeck's article on the Bugonia (1745).

Notices about my previous edition (1893), as far as they have come to my knowledge, have appeared in the following publications:

1°. The University Correspondent and University Correspondence College Magazine, London, Sept. 30, 1893, p. 11:
G. H. Bryan, M. A. — The Oxen-born bees of the Ancients; with the motto: „A bee, or not a bee, that is the question." Reprinted in Int. Journ. of Microscopy and Nat. Sc. Jan. 1894.

2°. „Nature", a Weekly Illustrated Journal of Science, London, April 12 1894, p. 555—556.
W. F. Kirby. Bees and dead Carcases.

3°. Wiener Entomologische Zeitung, Jan. 15 1894, p. 31.
Short notice by Prof. J. Mik.

4°. Berliner Entomologische Zeitschrift 1893, p. 390—391.
Short notice by Dr. Benno Wandolleck.

5°. The Illustrated London News, May 19 1894, p. 626, under the heading „Science jottings" by Dr. Andrew Wilson.

In consequence of a notice which I published in „Nature" Vol. 49, p. 198, Dec. 28 1893, containing a request to the public for more material on the „Bugonia", Dr. Ernst Krause, of Berlin, kindly sent me a separate copy of a paper of his, which appeared in the German Periodical „Kosmos“, Vol. IV: „Die mythologische Periode der Entwickelungsgeschichte“, and contains a paragraph about the superstition in question, p. 348—353. The same notice of mine in „Nature“ elicited in that periodical, Vol. 50, May 10 1894 a very interesting article: „Some Oriental beliefs about bees and wasps“ by Mr. Kumagusu Minakata, in London. To him I am also indebted for some communications by letter. Mr. W. L. Distant wrote to me from Pretoria, Transvaal, that he would make inquiries whether any Kafir folk-lore exists on the same subject.

I owe a debt of sincere gratitude to my friend Lieutenant-General Dunsterville for the great trouble he has taken in revising my manuscript, and assisting me in proof-reading. I am also grateful to Prof. Zangemeister, Director of the University-Library of Heidelberg, to Prof. Adalbert Merx, of the same University, and to Mr. W. F. Kirby, of the British Museum, for their interest and assistance in my work; and to Mr. Kumagusu Minakata, the Japanese *savant*, residing in London, for the very valuable communications from Chinese and Japanese literature, which I owe to his kindness.

Any communication of facts, or opinions, commendatory or critical, concerning my subject, will be gratefully received by me.

C. R. OSTEN SACKEN.

HEIDELBERG, July 10 1894.

NOTICES

ON SOME

OF THE AUTHORITIES CONSULTED.

This List contains the *principal* authorities only of which I have made use, especially such about which I wished to introduce some explanatory remarks. Authorities of minor importance are either mentioned in foot-notes, or in the Supplem. X. In the *Index* on pages XII—XIV **all** the authors quoted are alphabetically enumerated, with the corresponding references to the pagination.

The **Geoponica** or Work on Agriculture, is a compilation of old Greek and Roman authors on that subject, ordered by the Emperor Constantine Porphyrogeneta, and executed in all probability by Cassianus Bassus, a contemporary writer in the 10th century A. D. This work contains a chapter devoted to the artificial production of bees, which is attributed to Florentinus, an author who must have lived in, or before, the 10th century A. D., but about whom nothing else is known. (Comp. W. Smith, Dict. of Gr. and Rom. biogr. and mythol., under BASSUS and FLORENTINUS.) Professor A. Merx, of Heidelberg, the celebrated Syriac scholar, told me of an old Syriac translation of the *Geoponica*, which may possibly have been the channel through which the notion of the Bugonia spread eastwards. He added that the Hayât el-haiwân (the life of Animals) by *Damiri* (or Demiri), and other Arabic works, may contain allusions to the Bugonia.

The edition which I have used is: *Geoponicorum*, sive de re rustica, libri XX, Cassiano Basso Scholastico collectore, antea Constantino Porphyrogeneto a quibusdam adscripti, graece et latine post Petri Needhami curas ad MSS. fidem denuo recensi et illustrati ab Jo. Nicolao Niclas, Lipsiae 1781.

There is a work of W. Gemoll, Untersuchungen etc. der Geoponica, Berlin 1883, which may be useful to students in using this antique compilation.

Aldrovandi, De animalibus insectis, Bologna 1602, in fol. (the original ed.). The chapter on the Bugonia is on p. 58—60.

Ulysses Aldrovandi (1527—1605), Professor in Bologna, spent his life in collecting materials for his immense work on all branches of Natural History, consisting of 13 volumes, the publication of which lasted from 1599 to 1668. Only four volumes were published during his life-time; the rest was issued at the expense of the Senate of Bologna. This work, however, for the most part, is merely a crude compilation.

Samuel Bochart, Hierozoïcon; sive opus bipartitum de animalibus Sacrae Scripturae. London 1663. 2 vol. in fol.

This stupendous work of erudition was my principal source for references on the Bugonia. The Chapter 10, p. 502—505 in Vol. II, Book IV, contains a collection of such passages, which most of the later authors have borrowed from.

Bochart (1599—1667) was a protestant pastor in Caen, France, and at the same time, an eminent orientalist versed in Hebrew, Syriac, Chaldaic, Arabic, Ethiopian etc.

Francesco Redi, Esperienze intorno alla generazione degl' insetti, Florence, 1668.

F. Redi, born in Arezzo 1626, died in Pisa, 1697. He was the physician of the Grand Duke of Tuscany, and at the same time a naturalist, a poet, and a literary personage in general. His letters are charming. I possess a Neapolitan edition of his complete works in seven volumes, dated 1778, and shall quote from it.

I shall very often have the opportunity of quoting Redi, the first and the most ardent among the opponents of the craze of the Bugonia. But he contented himself with ridiculing it, without ever trying to explain its origin.

Antonio Vallisnieri, Esperienze ed Osservazioni, spettanti all' Istoria Naturale e Medica. Second edition. Padova 1726. The first edition is dated 1713. I quote from the second.

Antonio Vallisnieri (1661—1730) was Professor in Padua.

Réaumur, René Antoine Ferchault (1683—1757). Mémoires pour servir à l'histoire des insectes. 6 vol. 4⁰. Paris, 1734—42.

I quote from this original 4⁰ edition, and principally from Vol. IV (1738).

Joh. Heinr. Voss. Virgilii Georgicon, Libri IV, übersetzt und erklärt von J. H. V. 1789.

I have also consulted the excellent Commentary on the Georgics by J. Conington, London 1865, and made use of some of his remarks on the episode of Aristaeus. The Commentaries of Prof. Martyn, on the Georgica (London 1741 and 1749), which I find quoted in Smith's Diction. Biogr. and Mythol. etc. I have not been able to consult.

Joh. Beckmann. Antigoni Carystii historiarum mirabilium collectanea. Lipsiae 1791.

This is a learned commentary upon the work of *Antigonus* of *Carystus*. About the latter comp. Suppl. X, under *Antigonus*.

William Smith, Dictionary of Greek and Roman Biography and Mythology. — 3 vol. London 1853—56.

Gualterus Robert-Tornow. De apum mellisque apud veteres significatione symbolica et mythologica. Berolini, apud Weidmannos 1893.

This is an interesting compilation of passages from Greek and Roman authors, concerning bees and honey in mythology, literature and history. It contains many other references, etymological and historical from other sources, and is accompanied by a running commentary in latin.

This publication appeared in the same year with the first edition of my Essay on the Bugonia, so that I was not able to make use of it at that time.

R. Tornow quotes a certain Rabusius, author of the work: Von dem Veldtbau (Strassburg, 1566), which contains a chapter: „Von den Bynen, wie sie aus einem todten Rind wachsen.“ (On bees, how they grow out of a dead ox.) I have not been able to get access to this work.

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Corrigenda.

p. 2, l. 3 from bottom — for *before*, read *after*.
p. 19, l. 8 „ „ — for *Jokushin*, read *Tokushin*.
p. 78, l. 7 „ „ — for *Tyro*, read *Tiro*.
(The edition quoted by me has it *Tyro*, which is evidently a misprint.)

ON THE OXEN-BORN BEES OF THE ANCIENTS
(BUGONIA),
AND THEIR RELATION TO
ERISTALIS TENAX,
A TWO-WINGED INSECT,

BY **C. R. OSTEN SACKEN.**

> OXEN (1) are very useful animals, as much in agriculture, as in carrying burdens. They produce milk, they adorn altars, they embellish feasts; they give good food. Even dead oxen are praiseworthy and excellent, because from their remains originate bees, the most laborious of insects, which provide men with honey, the best and sweetest nourishment.
>
> AELIANUS, On the Nature of Animals, Book II, 57 (between the 2nd and 3rd Century A. D.).

§ 1. — *Introduction.*

For more than two thousand years a superstition has been prevalent in the minds of the masses, as well as in books, to the effect that, besides the usual production of honey-bees in hives, they originated by spontaneous generation from carcases of dead animals, and principally from those of oxen. Thus arose in Greece the term *Bugonia* (from βοῦς, an ox, and γονή, progeny), as well as the expression *bugenès melissae*, *taurigenae apes*, that is, oxen-born bees, in the Greek and Latin literature.

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(1) For want of a better expression, I use *„oxen“* in accordance with Webster's *Dictionary* (under *„Ox“*): „The name *Ox* is never applied to the cow, or female of the domestic kind. *Oxen*, in the plural, may comprehend both male and female.“ The expressions *„oxen-born“*, *„carcase-born“* etc. may be considered bad English; but it would have been impossible for me to express my meaning without them. New notions require new expressions.

„Greeks, Carthagenians and Romans spoke of the Bugonia as of an every-day occurrence (alltägliche Wahrheit); the Greeks called honey-bees simply *bugenès, taurigenae*“ (J. H. Voss, Virg. Georg. p. 277; 1789). The poet Archelaus, quoted by Varro, calls them the „factitious progeny of a decaying ox.“ In the Greek Anthology, the name *bupaides* (children of oxen) is attributed to them (Comp. V. C. Rost, Germ. Greek Dict.). We shall have occasion to give numerous other references from Greek and Roman literature. This superstition has also prevailed in Northern Africa and in some parts of Asia; it continued through the middle ages, and found expression even in the sixteenth and seventeenth centuries. „Infinite is the number of modern authors who are convinced that bees are born from carcases of oxen“, said the Italian Redi (Esperienze etc. p. 57). The friend of Luther, the learned and pious Melanchthon, considered it as a divine provision (comp. Supplem. VI); an Italian poet of the sixteenth century put it into verse (1); the great naturalist Aldrovandi (1602) accepted it without contradiction; the English naturalist Moufet (Theatrum Insectorum 1634) (2) spoke of it as a common occurrence (experientia rustica et vulgaris, p. 12); and the learned Bochart (1663) (3) admitted it as an undoubted truth.

Even Shakespeare has a passage referring to the Bugonia, proving that this superstition was well-known at his time. The passage is in Henry IV, Part. II.

King. 'Tis seldom when the bee doth leave her comb,
In the dead carrion . . . . . (4)

---

(1) Giovanni Rucellai (1475—1525), in Florence and Rome, died as Governor of S. Angelo. His poem: *Le Api,* Amsterd. latin. edit. 1681, p. 68, contains an account of the *Bugonia.* A fragment of it is reproduced by Redi (p. 54).

(2) About Moufet compare the notice in Supplement X, under Moufet.

(3) About Bochart, Aldrovandi and Redi compare the List of authorities, before the Preface.

(4) I owe the communication of this passage from Shakespeare to Prof. W. Ihne in Heidelberg.

The original cause of this delusion lies in the fact that a very common fly, scientifically called *Eristalis tenax* (popularly the drone-fly), lays its eggs upon carcases of animals, that its larvae develop within the putrescent mass, and finally change into a swarm of flies which, in their shape, hairy clothing and colour, look exactly like bees, although they belong to a totally different order of insects. Bees belong to the Order *Hymenoptera*, and have four wings; the female is provided with a sting at the end of the body; the fly *Eristalis* belongs to the Order *Diptera*, has only two wings, and no sting.

The final extinction of this absurd notion among civilized nations was due to two causes:

1.° among scientific men, to the confutation of the old belief in spontaneous generation, and the general recognition

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About Shakespeare's natural history there is an interesting article in the Quarterly Review, April 1894: Shakespeare's Birds and Beasts. On p. 362 the author concludes by saying: „His animated nature, that is his knowledge of natural history cannot be, and could not have been better *than Elizabethan*."

There is an old work: Letters on the Natural History of the Insects mentioned in Shakespeare's Plays, with incidental notices of the Entomology of Ireland. By R. Patterson, Treasurer of the Nat. Hist. Soc. of Belfast. London, W.S. Orr & Co. Paternoster Row, 1838. (There is also a later edition of 1842, see Hagen's Biblioth. Entom. I, p. 31.)

In this work the above-quoted passage from „Henry IV" elicits the following remark: An observation which will naturally recall to your mind the passage in which we learn from the Scriptures that Samson found „a swarm of bees and honey in the carcase of the lion." But seldom as any thing of the kind does occur in this kingdom, it did happen on one occasion in the County of Down, if some species of wasp was not mistaken for bees. The fact is recorded in the following words, extracted from the Belfast News Letter of Friday, 10th Aug. 1832. „A few days ago, when the sexton was digging a grave in Temple Cranney (a burying-place in Porta-Ferry) he came to a coffin that had been there two or three years, which he thought necessary to remove, to make room for the corpse about to be interred. In this operation, he was startled by a great number of wild bees, issuing forth from the coffin, and upon lifting the lid, it was found that they had formed their combs in the dead man's skull and mouth, which were full. The nest was made of the hair of the head, together with shavings that had been put in the coffin with the corpse."

(I owe this extract to the kindness of Mr. W^m^ Fr. Kirby, of the British Museum. The insect was evidently a wasp; a bee does not build its „nest" of hair and shavings.)

of the principle: *omne vivum ex ovo*, proclaimed by William Harvey (1651) and by the great Italian naturalist Redi (1668);

2.⁰ among the ignorant crowd, to the introduction of a sanitary police, which prevents carcases from lying about, and affording the spectacle of bee-like flies swarming around them.

§ 2. — *Causes of the long duration of the* Bugonia-*craze and circumstances of its final confutation.*

Modern commentators of Greek and Latin authors have treated the *Bugonia* with a contemptuous sneer, (1) without taking into consideration that a superstition so universal and so persistent cannot be dismissed so easily, and must necessarily have some foundation in fact. The refutation of an error is not complete, until the source of the error is revealed. In a short paper on the geographical distribution of the fly *Eris-*

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(1) Examples of the treatment of the Bugonia by different authors:

JOH. BECKMAN, editor of Antigonus Carystius (compare the *List of authorities*) says: „Verum tanti non est multum tempus insumere in originem inquirendam fabulae extra modum absurdae quam gravissimis et firmissimis argumentis confecit Franciscus Redi.“ (*Translation.* „It is not worth while to waste one's time in inquiring into the origin of such a remarkably absurd fable, which Redi has confuted with the strongest arguments.)

J. H. VOSS, in his Commentary to the Georgics, is equally contemptuous.

DR. PH. H. KÜLB, the translator of Pliny (in Osiander und Schwab's Collection) Stuttgart, 1853, p. 1286 says: Dass alles hier über die Wiederbelebung und Wiederherstellung der Bienen gesagte, Unsinn ist, braucht kaum bemerkt zu werden.

ROBERT-TORNOW, p. 27, *à propos* of the beautiful passage of Ovid (Fasti, I, 380) „mille animas una necata dedit“, quotes an absurd interpretation of it by W. Menzelius (Vorchristliche Unsterblichkeitslehre, Leipzig 1870, II, 13, p. 122): „Wenn nun auch Ovid vermuthet, die Seele des Stieres gehe, weil er so viele Pflanzen gefressen habe, zur Strafe in unzählige Bienenseelen über, welche die Pflanzen nur liebkosen, ohne sie zu verletzen, so ist das doch ein guter Witz, und die griechische Mysterienlehre nimmt das Sinnbild viel ernsthafter.“ (*Translation.*) „Now, when Ovid, also, surmises that the soul of the ox, because he has devoured so many plants, is, as a punishment, changed into innumerable bee-souls, which caress, but do not injure plants, this must be taken as a merry conceit, whilst the Greek mystery-lore takes the symbol far more seriously.“

talis tenax (Entomol. M. Mag. XXIII, p. 97—99, London, 1886), I introduced incidentally the explanation of the *Bugonia*, founded upon a resemblance of this fly to the honey-bee. (1) Already at that time it seemed strange to me that such a obvious and simple explanation had never been proposed before. Since then I have undertaken a regular search in entomological, as well as in other, literature, in order to ascertain if any approach to such a solution could be found in previous writers, and to inquire into the causes that had delayed it so long. The result of my inquiry forms the subject of my two successive papers (1893—94).

The principal factor underlying the whole intellectual phenomenon we are inquiring into, is the well-known influence which prevails in all human matters, and this factor is *routine*. „Thinking is difficult, and acting according to reason is irksome", (2) said Goethe. People see, and believe in what they see, and the belief easily becomes a tradition. It may be asked: If those people had that belief, that bees could be produced from rotten oxen, why did they not try to verify it by experiment, the more so as an economical interest seemed to be connected with it? The answer is that they did try the experiment, many and many times, and did obtain something that looked like a bee; but that there was a second part of the experiment, which, if they ever tried it, never succeeded, and that was, to make that bee-like *something* produce honey. If they did not care much about the failure, it is for the very simple reason *that they never became aware of it*. They got a swarm of flies, which they took for bees, and let them loose, in the belief that they had increased the number of these useful insects in their neighbourhood, and in the expectation that they would, like other bees, visit flowers, gather honey and bring it to their hives. The syllogism stood thus: bees produce honey; we have bees, *ergo* we must have honey. But it never occurred to them to verify the *minor* premise of the syllogism: we have bees. The passage in Ovid's Metamorphoses XV, 361—368 affords us a glimpse of this kind of mental state, and the words „the fact is known from experience": (*cognita res usu*) prove that the experiment of „making bees" (*apes facere*) as Florentinus calls it, was often repeated:

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(1) A still earlier mention of my explanation of the Bugonia will be found in „Science Gossip" Novemb. 1885, p. 242 by my friend G. H. Bryan, M. A., to whom I had communicated it verbally.

(2) „Denken ist schwer, nach dem Gedachten handeln unbequem." Goethe.

> Si qua fides rebus tamen est addenda probatis,
> Nonne vides, quaecunque mora fluidoque calore
> Corpora tabuerint, in parva animalia verti?
> I quoque, delectos mactatos obrue tauros
> — Cognita res usu — de putri viscere passim
> Florilegae nascuntur apes, quae more parentum
> Rura colunt, operique favent, in spemque laborant.
> Pressus humo bellator equus crabronis origo est.

Translation. If any further evidence is necessary to enhance the faith in things already proved, you may behold that carcases, decaying from the effect of time and tepid moisture, change into small animals. Go, and bury slaughtered oxen — the fact is known from experience — the rotten entrails produce flower-sucking bees, who, like their parents (1), roam over pastures, bent upon work, and hopeful of the future. A buried war-horse produces the hornet. (2)

No doubt there were at that time some men of a sceptical turn of mind who, not perceiving any palpable result from the operation, advised the country-people not to waste time and money upon it, but to procure bees in the ordinary way from other localities, as the race of bees would never entirely run out. Such was the attitude of Celsus, and after him of Columella, the author of a work on Agriculture, both of whom are quoted by the ancients as opposed to the practice (About Celsus and Columella compare my Supplement X, where I reproduce the principal passage of Columella).

The right understanding of the illusion in which the believers in the Bugonia lived, affords, it seems to me, the only possible explanation of the, otherwise incredible, fact that the experiments were repeated for centuries without causing any apparent disappointment. (1) The curiosity about witnessing the miracle of spontaneous generation may have contributed in encouraging the people in their perseverance.

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(1) Here Ovid, as parents, evidently means oxen.

(2) This line 368 is explained on p. 15.

The various manipulations recommended by ancient authors for the process of the Bugonia may be classed into two groups; one of them required the carcases, or only portions of them, to be *buried*; according to the other method, they were *shut up* in a box, or a shed, or a chamber. The former method may have been the cheapest, and was perhaps more used by country-people; the other, more expensive, proved, after repeated experiments, to be the more certain.

In Egypt they used to bury the ox with projecting horns, through which, after they were cut off, bees would emerge (Antigonus Carystius). The process mentioned by Ovid, in the above-quoted passage, consisted likewise in a burial. Mago, an old African writer about agriculture (compare Supplem. X), contended that it was sufficient to bury the paunch of an ox: Pliny advised to cover it with dung etc. The process of shutting up the carcase in a box, shed, or chamber, is said to have been recommended by two ancient authors: Democritus and Varro. It was afterwards illustrated by the poetical genius of Virgil, in his Georgics; and we possess a still later description in the Geoponica (XV, 2, 21—28), (2) a work on Agriculture published in the tenth century. This description, attributed to an obscure writer Florentinus, is quite detailed, and probably contains the latest improvements of the art. It runs as follows:

> „Build a house, ten cubits high, with all the sides of equal dimensions, with one door, and four windows, one on each side; put an ox into it, thirty months old, very fat and fleshy; let a number of young men kill him by beating him violently with clubs, so as to mangle both flesh and bones, but taking care

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(1) This explanation is introduced here for the first time, because it had not occurred to me when I was writing my first edition.

(2) About the *Geoponica*, comp. above, the *List of authorities.*

not to shed any blood; let all the orifices, mouth, eyes, nose etc. be stopped up with clean and fine linen, impregnated with pitch; let a quantity of thyme be strewed under the reclining animal, and then let windows and doors be closed and covered with a thick coating of clay, to prevent the access of air or wind. Three weeks later let the house be opened, and let light and fresh air get access to it, except from the side from which the wind blows strongest. After eleven days you will find the house full of bees, hanging together in clusters, and nothing left of the ox but horns, bones and hair" etc. (This passage is reproduced in Aldrovandi, p. 58; there is also a mention in Redi, p. 53.)

All these processes, ridiculous and preposterous as they seem, for obtaining bees, are nevertheless perfectly rational methods for procuring, not the honey-bee, but the oxen-born bee, *Eristalis tenax*. I have subjected them to a critical examination the result of which is too long to be inserted here, and for this reason, is relegated to my Supplement I.

Such vagaries would have been avoided, if the people, from the very beginning, had known how to distinguish a honey-bee from a bee-like fly. Until this knowledge was forthcoming there was no reason for not believing in the *Bugonia*.

Aristotle (1) knew that four-winged insects have the sting in the tail, and the two-winged ones in the front of the head; and for this reason, if he ever came in contact with *Eristalis tenax*, he would have recognized a fly, and not a bee, in it. — At any rate, although he was a believer in spontaneous generation, he never mentioned the *Bugonia* in his works.

But after Aristotle, for a period of about twenty centuries, the question of the *Bugonia* remained in abeyance, and the belief was accepted even by men of learning. I will show in the sequel that, as late as 1662, there was a Dutch *savant*, in whose presence an *E. tenax* was produced from putrescent matter, and who actually took it for a honey-bee, and the case before him as an instance of *Bugonia!*

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(1) ARISTOTELES, *Hist. Anim.* IV, 7, 4: „The winged ones among insects, are either two-winged, like flies, or four-winged, like bees; but none of those which have a sting in the tail are two-winged."

And IV, 7, 3: „Also the *myops* (probably *Haematopota caecutiens*) and the *oestrus* (Tabanus) have a hard tongue . . . . . because all that have no tail-sting use the tongue as a weapon."

Also in the: *De partibus anim.* IV, 6, 3—4, where Aristotle says that Diptera have but two wings, because they are lighter than Hymenoptera. I. B. MEYER, *Aristoteles Thierkunde*, Berlin, 1855, p. 209 has some critical remarks about these passages.

The thesis which I maintain is, that it is to *E. tenax* alone, that the origin of the belief in the Bugonia is due; in other words, that if this particular fly had not existed, the belief probably would never had arisen. But I shall show at the same time that there existed some other bee-, wasp-, hornet-, and humble-bee-like flies which, swarming about cattle and horses, served as *subsidiary agents* in perpetuating the Bugonia-craze.

E. tenax has the following qualifications which make it preeminently fitted for assuming the rôle of an oxen-born bee:

1.° It is more like a honey-bee than any other fly; the other flies, which have been named in connection with the *Bugonia*, have a different aspect; the *Oestridae* are more like humble-bees; *Helophilus* is more like a wasp.

2.° It oviposits on carcases in a state of far advanced decomposition in which its larvae thrive, and these habits correspond to the tradition of the oxen-born bee. The wasp-like *Helophilus*, a close relative of *Eristalis* in the zoological system, and developing, like that fly, from a rat-tailed larva, but of much less common occurrence, gave rise to the belief that wasps were also produced from dead animals, a craze which always prospered alongside of the Bugonia. As to the other flies, subsidiaries, as I have called them, to the same superstition, the *Oestridae* (*Hypoderma*, *Gastrophilus* and *Cephenemyia*) we shall return to them in the sequel.

3.° The very common occurrence of *Eristalis tenax*, and (as I will show in the paragraph about its geographical distribution) the truly fabulous rapidity of its propagation under favorable circumstances, must have struck, from the earliest times, the eyes and the imagination of the ignorant crowd, and, combined with the swarming of the fly round carcases and its bee-like aspect, have led quite naturally towards the belief in the Bugonia.

This thesis, that *Eristalis tenax* alone is the cause of the Bugonia-craze, being given, what remains for me to do is to show how, at the end of those twenty centuries of inertia, the question about the Bugonia came up again, and after some uncertainty and groping, found its solution in the recognition of the truth, that *E. tenax* was at the bottom of it.

A group of men, almost contemporaries, brought about that solution at the end of the seventeenth and in the first half of the eighteenth centuries, by dint of observing insects in life, and not by merely compiling authorities. These men were: Goedart (1620—1668), Blankaart (his work appeared in 1688), Swammerdam (1637—1680), all three in Holland; Redi (1626—1697) and Vallisnieri (1661—1730) in Italy, and finally Réaumur (1683—1757) in France.

GOEDART (*Metamorphosis insectorum* etc. 1662; edition in Dutch 1669) gives rough, but distinct, figures of the larva, pupa and imago of *E. tenax* (Tab. II, p. 25). He calls the larva *vermiculus porcinus*. The imago is distinctly figured as a two-winged fly, and the letter-press also speaks of two wings; nevertheless Goedart calls it *apis* (bee). That so careful and conscientious an observer should have taken a fly for a bee is out of the question. Swammerdam, who reproached him with this mistake (*Bibl. Nat. Germ.* ed. 1758, p. 212), changed his mind in another part of his work (p. 257), and took to task Dr. de Mey, Goedart's commentator, as the guilty party. Goedart was not a classical scholar; Réaumur (vol. I, p. 29) notices it in a passage, which is a choice specimen of French *finesse* and urbanity: „Ceux même (les naturalistes) qui, par une ignorance peut-être heureuse, n'étaient pas en état de lire les anciens, comme Goedart et M$^{\text{lle}}$ Mérian, ont travaillé utilement.“ It was the classically learned de Mey who saw in Goedart's observation an actual case of Bugonia; he took the *Eristalis* for a honey-bee, and composed a preposterous *Annotation* about it. Swammerdam, the representative of the new science, was seized with an almost ludicrous fit of wrath about this piece of presumption: „The fuss,“ says he, „de Mey makes about this story is truly astonishing, and plainly shows that he is equally ignorant of the nature of the bee, as of the nature of the fly. This is one of the bad habits of our day that statements are made on matters about which one knows nothing, for the mere purpose of getting a reputation of wisdom and knowledge.“ An amusing instance of the collision between the old and the new learning!

BLANKAART (*Schauplatz der Raupen, Würmer* etc. Dutch ed. 1688; German ed. 1690) describes and figures the larva, pupa and imago of *E. tenax.* The larva he calls (after Goedart) *Schweinmade.* Of the imago he says: „eine Art von zahmen Bienen (*Musca apiformis*) mit zwei Flügeln“ etc. („A kind of tame bees with two wings.“) He adds: „quite different from what Goedart taught us,“ a reproach which, as I have shown, is undeserved.

SWAMMERDAM'S (1637—1680) principal work, the „Biblia naturae“, (Leyden, 1737—38; in German, Leipzig, 1758), was published more than half a century after his death.

Swammerdam, in two passages of his „Biblia“, comes very near connecting *Eristalis tenax* with the Bugonia, and it is only his bias for a literal interpretation of a scriptural text, which prevents him from taking the last step that was needed. In his chapter on bees (p. 210—212) he says that because bees are cleanly animals, and never alight on carcases, the story of Samson has appeared to many strange and incredible. He offers an explanation very similar to that of Bochart (1) (whom he does not quote and does not seem to know), that the lion was not a corpse, but a skeleton. It was in the height of summer; the larvae of certain flies always occurring in carcases had, in a very short time, devoured all the flesh; the remaining skeleton was soon freed from all bad smells by the combined action of sun, rain and dew; under such circumstances it is possible („es lässt sich ohnschwer begreifen“) that the skeleton may have become the habitation of bees during the swarming season (p. 211, right column.). On p. 212 Swammerdam continues: „This story of Samson and his bees, misunderstood as it was, has undoubtedly given rise to the common ignorant craze that bees originate from lions, oxen and horses. The craze was probably confirmed by the sight of the great mass of worms which occur in such carcases in summer, the more so as these worms are somewhat („einigermassen") like the larvae of bees. This apparent resemblance has undoubtedly fortified this error, which, ridiculous and groundless as it is, has found advocates even among the most learned men. The laborious Goedart has not hesitated to make bees breed from dungworms, and the learned De Mey has shared his opinion, although what he took for a bee was nothing but a fly, which looked somewhat bee-like etc."

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(1) Bochart's explanation will be given further on p. 16.

In a later part of his work (p. 256—257) Swammerdam gives a detailed description (with figures) of the three stages of *Eristalis tenax.* He notices (p. 257 at the bottom) that the fly has been frequently taken for a bee, and that Augerius Clutius (1) in his little work on bees, has denounced this error. He exonerates Goedart of his supposed mistake, and charges De Mey with it (as I have already explained above).

It follows from these statements that Swammerdam was fully aware of the absurdity of the Bugonia-craze, but that he did not quite grasp the part played by *E. tenax* in it, and would not, even in the presence of sufficient evidence, give up his bias for a literal interpretation of the Holy Scriptures. In fact he connects the belief in the Bugonia with the story of the bees of Samson, as if the ancients (Greeks and Romans) knew anything about Samson!

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(1) THEODOR AUGER CLUTIUS, also called DIRCK CLUYT, Apothecary and Botanist in Leyden, at the end of the sixteenth and the beginning of the next century. His book: On Bees (Vande Bien etc.) appeared in Leyden in 1597 and had seven editions, the last in 1705. I borrow these statements from H. A. HAGEN'S, Bibliotheca entomologica, I, p. 133.

I have consulted the fifth edition (1648) which was kindly lent to me by the Grand Ducal Library in Carlsruhe. — Clutius also speaks of the *Oestridae* (p. 10).

The „Augerius" (misprinted *Augenius*) referred to by VALLISNIÈRI, *Esperienze* etc. p. 149; (1726), is evidently the same Clutius.

Redi, a contemporary of Swammerdam, stood on the same level with him on the question of the Bugonia. Both were adversaries of spontaneous generation, and nevertheless both misunderstood the story of Samson. Redi (*Esperienze* etc. p. 58) accepts the interpretation of Bochart. And with regard to the relation of bee-like flies, and especially of *E. tenax* to the Bugonia, both seem to have been in the dark. My Neapolitan edition of Redi (1778) contains a supplement by Girolamo Gaspari from Verona (p. 149), an observer of Oestridae and correspondent of Vallisnieri, who states quite distinctly that Redi only denounced the error, and that it was Vallisnieri who explained its origin. There is no doubt that it is to the latter that belongs the honor of having pointed out that the vagaries of the ancients about oxen-born bees were not mere inventions, but had some basis in facts. (1) As early as 1700 Vallisnieri published his „Dialogues between Malpighi and Pliny in which he showed that what the ancients took for oxen-born bees, were those bee-like hairy flies that breed under the skin of cattle (our *Hypoderma*), or escape from the throat of deer (*Cephenemyia*), or are seen about horses, asses and mules (*Gastrophilus*). Vallisnieri repeats these statements in his Esperienze, p. 148. But this discovery of Vallisnieri was not up to the mark yet; what he discovered were *Oestridae*, and not *E. tenax*. And yet, that Vallisnieri knew *E. tenax*, may be inferred from his words: „that stout and stupid fly, which is bred from certain worms, provided with a tail, and sometimes called *aquatic intestines*, (*intestini acquatici*)“ (*Esperienze* etc. p. 149). On the same page Vallisnieri gives instances of the confusion between the terms of *bees* and *flies* in ancient authors, and quotes, among others, Lampridius, *Life of Heliogabalus*, Ch. 26. I translate this passage of Lampridius: „As a gift to his parasites,

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(1) In the Suppl. V I have shown that traces of this progress in knowledge are found even in earlier authors.

Heliogabalus oftentimes sent them vessels filled with frogs, scorpions, snakes, and other disgusting animals. Such vessels were sometimes filled with numerous flies, which he called *tame bees.*" These tame bees were undoubtedly *Eristalis tenax*, and the practical joke of the Roman emperor consisted in frightening his friends with them.

Réaumur (*Mém.* vol. IV. 439) came a little later than the above-quoted authors, and made use of their works (Compare vol. I, p. 29 and vol. IV, in many passages about Vallisnieri). It is Réaumur who, for the first time, brought the Bugonia and *E. tenax* distinctly together. At the very beginning of the chapter: „Of two-winged flies which look like bees", in which he gives the life-history of this fly, the following passage occurs: „such resemblances (between certain hymenoptera and diptera) have deceived people at a time when observations were not very accurate; such resemblances have made people believe that honey-bees, humble-bees, hornets and wasps originate in putrescent matter upon which those other flies occur." („Ce sont ces mêmes ressemblances qui en ont imposé dans des temps où l'on n'y regardait pas d'assez près; ce sont ces ressemblances qui on fait croire que les abeilles, que les bourdons, que les frelons et les guêpes venaient de certaines matières pourries sur lesquelles on trouvait les autres mouches.") — This is the explanation of the Bugonia in a nutshell.

Réaumur's observations on rat-tailed larvae refer to two genera of diptera:

Eristalis (his *mouche à forme d'abeille*), represented by *E. tenax* (the carcase-born *honey-bee* of the ancients) and another species, probably *E. arbustorum.*

Helophilus (his *mouche à forme de guêpe*), *the carcase-born wasp* of the ancients (Comp. Réaumur IV, p. 440 and 474).

Besides these two forms of diptera, a third one, also described by Réaumur (IV, 541—551), although not produced from a rat-tailed larva, has been connected by the ancients with the Bugonia; this is our Gad-fly (*Gastrophilus equi*), a parasite of the horse, the brownish color of which probably gave rise to the belief that it was the horse-born *hornet*. Thus it happened that the *hornet* became, in the mind of the ancients, always connected with the horse, just as the honey-bee with the ox. (1)

But Réaumur was working at a time when a systematic nomenclature of Entomology was not yet introduced, and that prevented him from expressing his meaning with more precision, in other words, from *naming* the species which he meant. Thus it happened that the very important, but perhaps too concise, passage which I have quoted, has ever since been entirely overlooked, as if it had never existed. I have searched in vain in Kirby and Spence, in Westwood's Introduction, (2) and in other entomological works for any other passage, either alluding to Réaumur, or offering an independent explanation of the origin of the Bugonia. (3) A full exposition of the subject became therefore necessary.

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(1) In Supplement V will be found a more detailed statement about the identification of the *horse-born hornet* of the ancients with the Gad-fly, *Gastrophilus equi*. In the same place I explain the error committed by several ancient authors in confounding this horse-born *hornet* with the carcase-born *wasp* (the mouche-guêpe of Réaumur, our *Helophilus*). The former is a parasite of the horse, and therefore was rightly always connected with it. The latter (*Helophilus*, carcase-born wasp of the ancients) is not a parasite, and is not in any way particularly connected with the horse; its rat-tailed larva may develop in any kind of water containing decaying organic matter.

(2) The passage in *Westwood*, Introd. II, p. 557: „Many species so much resemble humble bees, wasps and other Diptera, that they are constantly mistaken for them by the inexperienced“ contains no reference whatever to the *Bugonia*.

(3) Since the publication of my first paper on the Bugonia, Prof. A. Giard of Paris has called my attention to a recently published volume in which, for the first time since Réaumur, *Eristalis tenax* is mentioned in connexion with the oxen-born bees of the ancients. In the 4th volume of the „Souvenirs Entomologiques“ by J. H. FABRE (p. 260; 1891) this author, in mentioning *E. tenax*, calls it „the virgilian bee“ (l'abeille virgilienne), without any other comment: at any rate this proves that he shares my view in that matter.

§ 3. — *The Bugonia in the literature of the world.*

The origin of the belief in the Bugonia must be sought in prehistoric times, when country-people, keeping cattle and bees, observed bee-like flies swarming about dead animals. The earliest appearance of the belief in literature is found in the story of Samson (*Judges*, XIV, 8, 9, R. V.) of which I have already spoken in the paragraph about Swammerdam. In the vineyards of Timnah Samson had killed a lion, and „after a while“, on his way to fetch his bride, „he turned aside to see the carcase of the lion: and behold, there was a swarm of bees in the body of the lion, and honey; and he took it into his hands, and went on, eating as he went“ etc. As soon as a myth is started, it begins to grow. The seeing of a swarm of bee-like flies was a fact; the finding and eating the honey was the myth grown out of the misconceived fact. The riddle, which Samson proposes afterwards, affords the proof of another fact: that the belief in the Bugonia was current among the people at that time; because, without that *substratum*, the riddle would not have had any meaning:

„Out of the eater came forth meat
And out of the strong came forth sweetness.“

The narrator of the tale arranges it so as to make it a preamble to the riddle: When Samson gave the honey to his parents *he did not tell them* that he had taken it from the body of the lion; because if he had told them, they (as believers in the Bugonia) would have had nothing to guess. The story therefore presents a real occurrence, based upon a well-observed, but wrongly interpreted, natural phenomenon.

It is curious to notice how Sam. Bochart (vol. II, p. 502) comments on this passage of the Book of Judges in order to meet possible objections. He admits that bees, besides their natural origin in hives, are produced from dead oxen, in conformity to the opinion of numerous ancient authors; but he scoffs at the ignorance of those who, relying on the scriptural text, admit two kinds of animal-bred bees, and attacks especially Moufet on that matter: „Nec audiendus Mufetus Anglus qui in Insectorum Theatro alias apes scribit esse *leontogenes*, alias *taurogenes*.“ (*Translation:* Nor is the Englishman Moufet to be heard, when in his *Theatrum Insectorum* he distinguishes *lion-born* from *oxen-born* bees.) In order to explain the appearance of bees about Samson's lion, Bochart establishes three propositions:

1.^{0} Although it is stated in the text that the bees were in the carcase, it is not stated that they were *born* there („apes in leonis corpore fuisse repertas, non tamen ibi natas“).

2.^{0} That between the killing of the lion and the finding of his remains *a whole year* had elapsed, because the expression „after a while“ (*post diem*) in Hebrew must be understood to mean a whole year. A host of authorities are adduced by Bochart to sustain this strange proposition.

3.^{0} That at the end of a year the corpse was reduced to the state of a clean skeleton, in which the bees could take shelter without repugnance, the bees being clean animals.

But Bochart does not explain how those cleanly bees which could not stand a rotten lion, could be born from rotten oxen? The mental attitude of Bochart in this instance is very strange, and exemplifies the immense sway the ancients exercised over European learning even in the second half of the XVII$^{\text{th}}$ century. He blindly adopts the Bugonia of the ancients, but criticises Samson's story not because he considers it absurd, but because nothing is found about the origin of bees from lions in the ancient authors. Réaumur (Mém. I, p. 28) was right in saying: „It was believed at that time that every kind of truth could be recovered in the writings of the ancients, that the ancients knew everything, understood everything . . . The observation of nature seemed to have no other aim than to confirm what had been found in the ancients etc.“ (comp. Supplement III).

About the time when I published my above-quoted article (p. 3) in the *Entom. Monthly Magazine*, and showed that Samson's bee was nothing but *E. tenax*, I communicated my solution of the story of Samson to the eminent Professor of scriptural exegesis in Heidelberg Dr. Adalbert Merx. At the same time I handed to him a box, containing about half a dozen of pinned specimens of *Eristalis tenax*. He received this communication with evident delight, and recognized that it offered a simple solution of a text which had been discussed for centuries. Soon afterwards, he published in the german „Protestantische Kirchenzeitung“ No. 17, 1887, p. 389—392 a learned article, entitled: „Der Honig im Cadaver des Löwen“ (The Honey in the Carcase of the Lion) (1). It contains a summary of the discussions provoked by Samson's bees, and the controversies of ALPHONS TOSTATUS, Bishop of Avila († 1454), of LORINUS OF AVIGNON (1559—1634), and the Jesuit BONFRERE (1573—1643). Professor Merx concludes by accepting the resemblance of *E. tenax* to a bee as a natural solution of the question. „All the persons, says he, to whom I showed the specimens of *Eristalis* at once recognized bees in them, except a medical man who had some knowledge of entomology.“ (2)

It is very probable that many other instances of Bugonia occur in Oriental literature, but it is beyond my province to look after them. In my scanty reading of such authors, I found only one instance which seems to point that way. Massoudi (died 955 in Cairo) in his „Golden Meadows“ (translation by Barbier de Meynard and Pavet de Courteille, Paris 1861, vol. III, p. 233) relates a conversation which took place in Arabia and of which this is a fragment: „Had the bees which produced this honey deposited it in the body of a large animal, asked Yiad? — The surveyor answered: „Hearing that there was a hive near the seacoast, I sent people to gather the honey. They told me that they found at that place a heap of bones, more or less rotten, in the cavity of which bees had deposited the honey that they brought with them.“ This case, as a parallel to Samson's bees, is a remarkable instance of the force of imaginative association in the human brain, and of the sameness of its illogical action under similar circumstances. In both cases a carcase was seen, with *E. tenax* swarming about it, and in both cases the witnesses, taking them for bees, amplified their tale by the addition of an imaginary honey. Unlike Samson's story, where the condition of the carcase has been a matter of dispute among interpreters, the Arabian case distinctly admits the state of rottenness, and thus *primâ facie* betrays its absurdity, as bees are proverbially cleanly animals. We shall presently mention a similar instance of imaginative association from China.

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(1) The translation of Prof MERX's paper will be found in Suppl. VIII.

(2) JOHN CURTIS, *Brit. Ent. Diptera*, N. 432. *Eristalis nubilipennis*, says: „I have had some difficulty to convince persons totally ignorant of Entomology, that the *Eristales* were not bees, and it is worthy of observation that, when resting, the *Eristalis tenax*, and probably the whole genus, heave their bodies up and down as bees do, as if they were panting.“

Since the appeal to the public which I published in „Nature“ Dec. 28 1893 (comp. above, the Postscript of the Preface), a very interesting article appeared in the same paper on May 10 1894, about the mention of *Eristalis tenax* in the Chinese literature of former centuries. The author of the article (Mr. Kumagusu Minakata) has had the kindness to complete his statements in a further communication by letter. It seems that in China, like anywhere else, this fly was confused with the honey-bee. Observing it to visit out-houses and cesspools, the Chinese druggists concluded that the pretended bee went to such places to collect ingredients for honey. A „Materia Medica“ of the XVIth century by Li Schi-Chin contains such an assertion as a positive fact. Jokushin Kaibara, a moralist and naturalist in Japan (1628—1714) in his „Materia Medica“ (1708) refutes this assertion. But in China the majority of druggists entertained this opinion formerly, and perhaps may do it even now. A Chinese writer of the XVIIth century, Sie Tsái-Kang in his „Miscellanies of the Five Phenomena“ (1) (Japanese edition

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(1) The five Phenomena are: Heaven, Earth, Man, Thing, and Act (probably meaning: Deed, Action?).

1661, book IX, p. 43) says: „In Chang sha of Tsü I saw honey-bees without stings, so that when trifled with upon the palms they were quite harmless; having no difference from flies, that was strange!“ This is again an evident confusion of the *Eristalis* with a bee! But in another, later publication, the „Ryoan Ferashimas“ (Illustrated Cyclopedia of Three Systems in Japan and China) compiled in 1713 (new edition 1884, book LIII, p. 540) the distinction is already made and *Eristalis* is described: „a sort of fly shaped like a bee, but bigger, round and fat, coloured yellow and black; the worm, feeding on ordure, after moulting, changes into this insect. They are abundant in the season when turnips blossom: the nectar of herbaceous flowers they suck; they do no harm either by sting or by bite. They hum with their wings, whose sound is like saying „Bun Bun“, (which is the Japanese name of the fly)“. In his reading of Chinese literature, Mr. Kumagusu Minakata has not yet come across any passage, indicating the existence of the Bugonia-superstition in China, but, in his letter to me, he observes that, owing to the vastness of this literature, what he could hitherto master „is in truth but a hair out of nine oxen.“

In the Greek and Roman literature references to the Bugonia are very abundant. They begin with an old poet *Eumelus* (W. Smith, Dict. of Greek and Roman Biogr. and Mythol. sub voce *Eumelus*), said to have lived in the 8th century before Christ, and mentioned as the author of a poëm called Bugonia. The myth of Aristaeus, the demigod, benefactor of mankind, who, among other services, taught men to hunt and to keep bees, is the subject of the well-known episode in the Georgics of Virgil (IV, verses 281—559), embracing nearly 300 hexameters. The substance of the story is that Aristaeus, son of Apollo and of a Thessalian girl, named Cyrene, once upon a time lost his hives by famine and disease. In his distress he applied to his (now deified) mother; and through her intervention, and that of the sea-god Proteus, he was initiated into a mystic rite, by which swarms of bees were produced from slaughtered oxen. This myth was for the ancients the alleged origin of the Bugonia. It contains an account of the process used for obtaining bees, which agrees, in the main, with that of Florentinus (p. 7 above). I give a detailed analysis of both processes in the already quoted Supplement I.

Egypt, under the Ptolemies, seems to have been a centre of this superstition, and Virgil, in the above-quoted episode, refers to it too (verses 287—291). But the principal author quoted is *Antigonus Carystius,* who lived in the third century B. C.; he relates that „in several places in Egypt, when an ox is buried in such a way that his horns portrude, and these horns are sawn off, bees are said to emerge, the putrefying ox being transformed into these insects.“ The reason alleged for this experiment was that the yearly inundation of the Nile often destroyed the hives, and rendered the renewal of the stock necessary! (Comp. Joh. Beckmann; Antig. Car. hist. mir. collectanea. Lipsiae 1791, p. 36.)

Half a century before Virgil, Varro, „the most learned of the Romans“, as he was called, a contemporary of Cicero, in his book on Agriculture (De re rustica, book II, Ch. 5) praises the oxen in the most extravagant terms: „They are peculiarly Italian animals, because even the name of Italy is derived from them . . . . they are associates of man in field-labour, and servants of Ceres; . . . . the ancients respected them so much that killing them was punished with death (1) . . . . Such is their greatness (*majestas*) that their name is added to things described as excessive, a large fig (*busycon*), a big child (*bupais*), excessive hunger (*bulimos*), ox-eyed (*boopis*), and a large bunch of grapes (*uva bumamma*) . . . . Jupiter chose to assume the shape of an ox when he carried Europa over the sea: an ox saved the children of Neptune and Melanippa from being crushed by a herd in the stable; *finally, it is from rotten oxen that are born the sweet bees, the mothers of honey, which the Greeks, for this reason called bugenès.*“ . . . . (2)

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(1) This reminds us of the Hindu's reverence for oxen.

(2) After this follows a passage the text of which is evidently corrupt and

In another place Varro (l. c. III, 16, 4) quotes two passages from the old poet Archelaus. In an epigram Archelaus calls the bees (in Greek)

> „Factitious children of a rotten ox“

which Bochart translates: „Corruptae bovis factitiam prolem.“

The other passage says:

> „The horse produces the wasp, the young bullock, bees.“

The often-quoted passage in Pliny (XI, 20) says: „dead bees preserved under cover during winter, and then dried in the vernal sun and covered with cinders of a fig-tree, can be restored to life. When they are hopelessly lost, they can be obtained again by covering the paunch of an ox with dung, or, as Virgil says, from the dead body of a young bullock. In the same way hornets and wasps can be obtained from dead horses, and beetles from dead asses; so does nature change one thing into another (mutante natura ex aliis quaedam in alia).“ This is the passage in which, to the astonishment of Aldrovandi (p. 58), Pliny quotes Virgil, and not Aristotle (comp. below p. 26). In this passage, as well as in the second one of Archelaus, quoted above, we find the hornet and wasp connected with the horse, a connection which I believe to have succeeded in explaining on p. 15 and in the Supplement V.

Ovid has two passages, one in the „Metamorphoses“ the other in the „Fasti“. The first I have already reproduced on p. 6.

The other passage relates how Aristaeus, having put the sleeping Proteus in fetters, compels him to reveal the art of producing bees. Proteus answers:

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incomprehensible: „et hunc Plautium locutum esse latine quam Hirrium praetorem renuntiatum Romam in senatu scriptum habemus. sed bono animo es. non minus satisfaciam tibi, quam qui Bugoniam scripsit.“ I follow the edition of H. Keil, Leipzig 1889. The lexicographer K. E. Georges must have had another text in view when, sub voce *Bugonia* he quotes this very passage and adds: Titel einer Schrift von Archelaus.

Qua, dixit, repares arte, requiris, apes?
Obrue mactati corpus tellure juvenci:
Quod petis a nobis, obrutus ille dabit.
Jussa fecit pastor. Fervent examina putri
De bove: mille animas una necata dedit.

Ovid. Fasti, I, 376—380.

Translation. You want to know how to replace, by art, the bees you lost? Cover with earth the body of the slaughtered bullock. What you ask from me, the buried carcase will give you. The shepherd did as he was bidden. Swarms rush from the rotten ox: and one extinguished life produces a thousand.

It will be noticed that in the two passages of Ovid the carcases are *buried*, and not kept in a closed box or shed, which is the process recommended by Virgil and Florentinus.

The various methods for the artificial production of bees excite the merriment of Francesco Redi (Esperienze etc. p. 52): „This is one of those lies (menzogne), he says, which happened to be invented by somebody in olden times and were afterwards repeated by others, as if they were true, and copied again, and each time with some addition; different authors do not relate the same thing in the same way about that marvellous generation, and are sometimes not consistent with themselves.“ Columella declares that he does not care to waste his time with such things, and adheres to the opinion of Celsus, who contends that the whole race of bees will never perish, and that it is therefore useless to look for them in the entrails of oxen. Nevertheless Mago, quoted by the same Columella, teaches that the paunch alone of the ox is sufficient for the purpose: Pliny adds that it is necessary to cover it with dung etc. etc. Redi goes on in that style for many pages. I have shown (on p. 8 and in Suppl. I) that all these methods have a *raison d'être* behind them, and that the result of them all is the production of the oxen-born bee, *Eristalis tenax*.

The illusion that *E. tenax* was a real bee, led the ancients into exaggerations, connected with the habits of real bees. So it was contended that the „King“, or what we now call the Queen-bee, was produced from the brain of the ox, the ordinary bees from its flesh: („Aiunt ex cerebro gigni Reges, ex carnibus vero alias apes“), that they congregated about the king in large clusters, just as bees do (Florentinus) etc. Another development of the myth consisted in asserting that, while bees came from oxen exclusively, wasps originated from asses, drones from horses, hornets from mules (Servius, ad Virg. Georg. 4). Others again make the wasps come from horses etc. In such a confusion of undigested assertions it is often difficult to discern what the authors believed in, and what they merely repeated from hearsay. The usual excuse for such statements is the word „they say“ (aiunt), which is repeated constantly. Here again, Redi makes merry about it (p. 64): „Antigonus, Pliny, Plutarch, Nicander, Aelian und Archelaus, quoted by Varro, teach us that wasps originate from putrid horses. Virgil asserts this not only about the wasps, but also about hornets. Ovid (Met. XV, 368) is silent about the wasps, and mentions only the hornets:

Pressus humo bellator equus crabonis origo est.

„Thomas Moufet says that the harder flesh of horses produces hornets, the softer, wasps. But the Greek commentators of Nicander attribute this faculty not to the flesh, but to the skin; the condition however is that the horse should have been bitten by a wolf! Georgius Pachymeres affirms that the wasps originate neither from the flesh, nor from the skin, but from the brain. Lando says that hornets originate from the brain of asses. But Servius Grammaticus, mixing up everything (sconvolgendo ogni cosa) says that from horses come the drones, from mules the hornets, and from asses the wasps. Olympiodorus, Pliny, Cardanus, Porta assert that the ass produces drones and beetles, but not wasps, and Horus in the twenty third chapter of the second book on Hieroglyphics, speaks of wasps, issued from the flesh of crocodiles; on the contrary Antigonus, in the twenty third book of his *Historiae mirabiles*, pretends that the crocodile produces not wasps, but terrestrial scorpions etc.“ (Notices about all the authors mentioned by Redi in the preceding passages, will be found in the Suppl. X.)

Among all these vagaries there are grains of truth, and facts based on actual observation. The assertion of the commentators of Nicander, for instance, that bees or wasps are produced from the skin of animals, evidently refers to bot-flies (*Oestridae*). The larvae of the genus *Hypoderma* occur in the skin of living oxen, horses, asses etc.; the flies resemble humble-bees much more than honey-bees. The confusion between wasp and hornet, in connection with the horse, which I have explained above, seems also to have puzzled Redi.

The story of wasps or hornets, originating in carcases of dead horses (Aelian, De nat. anim. I, 28; also Ovid) gave occasion to the celebrated German scholar and critic Lessing, to compose, under the guise of a fable, a very malignant and unjust epigram against the Italian nation (Lessing, Fabeln, I, 16: Die Wespen). (1)

The climax of the absurdities of the spontaneous generation was reached when it was contended that the vertebral column of a dead man could sometimes be converted into a snake:

> Sunt qui cum clauso putrefacta est spina sepulcro
> Mutari credant húmanas angue medullas. (2)

Such are the words which Ovid (Met. XV, 390) puts into the mouth of Pythagoras. The same myth is mentioned in Plutarch (Cleomenes, at the end): I reproduce the passage here, because it has also reference to the Bugonia: „A few days later, those who watched over the body of Cleomenes fastened to the cross, saw a large snake coiled around his head, as if to prevent birds of prey from resting upon it . . . . The inhabitants of Alexandria went to the place to worship Cleomenes as a hero and a son of God, until wiser men explained to them that just as bees are born from dead cows, wasps from dead horses, and dung-beetles from dead asses, snakes grow out from the human body, when the fluid in the vertebrae coagulates and is hardened. This observation caused the ancients to revere snakes, above all animals, as being connected with heroes.“

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(1) My attention to this epigram I owe to Mr. R. Pilet, the accomplished member of the French Consulate in Mannheim. The german text of it, with a translation, will be found in the Supplement VI.

(2) (*Translation*) „Some people believe that when a human spine is decaying in the grave, the marrow changes into a snake.“

I have already noticed above (p. 8) that the Greek author who was the best informed about bees (Aristotle) never mentions the Bugonia, although he was a believer in spontaneous generation. In the two works in which he treats of bees, the „History of Animals“ and „On the origin of animals“, not a word is to be found about the origin of bees from oxen. The celebrated Italian naturalist Ulysses Aldrovandi, who wrote about two thousand years after Aristotle is astonished at this omission. In his volume: De animalibus insectis (Bologna, 1602), p. 58, he says: „Mirum insuper cur Aristoteles e bove nasci (apes) etiam non scripserit, quin nescierit; nam Plinius Virgilium citat, non Aristotelem.“ (It is strange that Aristotle has nothing to say about bees, originating from oxen, as if he knew nothing about it; because Pliny quotes Virgil and not Aristotle.) (1)

Now Aristotle was very cautious in his statements about the generation of bees, as appears in the following passage concerning the relations between queens, drones and working bees: „The facts observed are as yet not sufficient, but in case they were, we ought to attach more importance to observed facts, than to theories, and to believe in theories then only, when they agree with the facts.“ (Aristotle, On the Origin of Animals, III, 101. I follow the translation of Drs. Aubert and Wimmer, Leipzig, 1860, p. 267.)

The juxtaposition of Aristotle and Aldrovandi as scientific observers affords a striking illustration of the stagnant state of natural science during the twenty centuries which separate them. Aldrovandi gives a certain number of references on the Bugonia, and, instead of expressing an opinion about them, quotes a passage from Galen, which is merely an avowal of ignorance:

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(1) Vallisnieri has this about Aldrovandi (*Esperienze* etc. p. 147; 1726): quello che ammiro, si è, che l'Aldrovando non ha altro fondamento di dubitare, se non che, come e' dice, *id ab Aristotele neutiquam animadversum video.*

E perch' egli è Aristotele, bisogna
Credergli, ancorchè dica la menzogna.

„Cur vero ex bovis putrefactis generentur apes occulta ratio est vel Galeno testante his verbis: „Si quispiam vero a nobis rationes (naturae) quaerat, eamque omnia a se ipsa doctam ex seseque discentem agere sciat. Neque enim quo pacto vermes in plantis gignuntur, aut ex equis bobusque vespae atque apes, facile nos dicere licet, verum a natura simpliciter fiunt, nam neque aves docet volare quispiam, neque nos intelligere, audire, videreque." (Galen, An animal sit, quod in utero continetur, Ch. 5.)

Translation: „How rotten oxen can produce bees, is a mystery; as Galen says: Anyone who inquires into nature's ways must understand that she is her own teacher, as well as her own disciple. It is not easy to say how worms generate in plants, or wasps and bees in horses and oxen; they are spontaneous works of nature, just as nobody has taught birds to fly, nor ourselves to hear, to see, and to understand."

At the end of his chapter on Bugonia, Aldrovandi (p. 60) reproduces a curious passage from a book „De Sale" by Bernardinus Gomez Miedis Saguntinus (Comp. Suppl. X, Miedis from Murviedro in Spain); a passage which requires an explanation. Miedis was amusing himself with watching bees at work, when he observed a „thing new, never heard of, nor seen before, nor mentioned by any author" (rem novam inauditam, neque visam hactenus, neque ab ullo scriptore, quod sciam, memoriae proditam). He squeezed a drone between his fingers to ascertain whether it had a sting, when suddenly some ligaments giving way, a well-formed reddish bull's head was protruded, with crooked and expanded horns, and a curved proboscis. The persons present were very much astonished, and insisted upon Miedis repeating the experiment; whereupon he squeezed five more drones in the same way, and saw five more bull's heads protrude from them. „It seems therefore", adds Miedis, „that Nature, which with good reason takes great care of bees, shows in this miracle how they may be recovered when lost."

This is an admirable instance of a perfectly accurate observation, most ridiculously misinterpreted for mere want of preliminary knowledge. The thing that was made to protrude by squeezing the abdomen of the drone was the forceps, peculiar to the male of nearly all insects, by means of which they take hold of the female. The forceps of the drone shows indeed a rough likeness of a bull's head, but that has nothing to do with the Bugonia. The experiment can easily be verified in autumn, when male bees of any kind, and male wasps, are abundant.

In the beginning of this paper (p. 2), I have mentioned among the believers in the Bugonia, Melanchthon (1497—1560), the Reformer, and the friend of Luther. He compares the miracle of the Bugonia to the Christian Church, but illustrates the comparison in such a manner that I do not deem it fit to be reproduced here. (Compare J. H. Voss, Virgilii Georgicon, libri IV, translated and commented upon, 1789, p. 277.) It is probable that Melanchthon, in this instance, was influenced by Ephraim the Syriac (Carmina Nisibena, 39, 210, quoted by Professor Merx), who makes a somewhat similar comparison. (1)

§ 4. — *Life-history and geographical distribution of Eristalis tenax.*

It is now time for me to say something about *Eristalis tenax* Linné, that bee-like fly, the resemblance of which to a honey-bee has confused the brains of the scientific and unscientific world for so many centuries. I shall give a short account of its outward appearance, its metamorphosis from the larva, and of some remarkable circumstances connected with its geographical distribution. It belongs to the large family *Syphidae* which contains a considerable number of handsomely coloured flies, very fond of flowers; „they fly with amazing rapidity, and many delight to hover immovably over certain spots, to which they will return, if disturbed for a considerable number of times“ (Westw. Introd. II, p. 557). Their colouring consists in many cases of yellow crossbands and spots on the abdomen, and also of similar marks on the thorax; or else they are clothed with a hairy covering of different colours.

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(1) The utterance of Melanchton I have reproduced in the original German in Supplement VI.

The passage of Ephraim the Syriac will be found in the Supplement VIII, at the end of Prof. Merx's paper.

E. tenax is of a duller colouring than most of the species of the family and, in that respect, it has remarkable resemblance to a honey-bee." This resemblance is so great (says Réaumur, IV, p. 440) (1) that, accustomed as I am to see bees, I hardly ever dared to take one of these flies in my hand without hesitation . . . . The colours, the size, the conformation and the proportions of the different parts of the body of these two insects, belonging to two different Orders, are very much alike. The bees have a slightly more elongated body, and their head is proportionally smaller. The fly keeps the wings more or less divaricated; on the contrary bees at rest keep them above the abdomen, the one covering the other: but in sucking flowers, or collecting wax, they often have them divaricated. Both insects frequent flowers and behave upon them in more or less the same manner“ etc.

Here is another testimony from a person who, without any previous acquaintance with *E. tenax*, was struck by its resemblance to a bee; he writes to the Entomological Division of the Dep. of Agric. in Washington: „I send a cage of insects which made their advent in our green-house with the blooming of *Farfugium grande*, in the economy of which flower they are apparently in some manner concerned. They act like bees, and greatly resemble them, not only in the busy way in which they work among the flowers, but in the way they fly, and carry their hind legs imitating the pollen-freighted limbs of the bee. All whose attention I have called to them, or to whom I have shown the insects, mistake them for honey-bees. — They evidently fulfil the same office, with relation to the composite above-mentioned, as the honey-bee, of which they are such a good imitation." (Ernest Walker, Indiana, Oct. 27, 1892; in „*Insect-Life*", Jan. 1893, p. 200.)

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(1) There is an evident error in Réaumur, in the reference to the plate XXXI fig. 8. The true *E. tenax* is represented (rather indifferently) on pl. XX figure 7; compare the explanation of this figure on p. 283, Mouche en forme d'abeille etc. Plate XXXI figure 8 is correctly quoted p. 474 and represents *Eristalis arbustorum* ♀, or some allied species.

The colouring of the abdomen of the honey-bees is variable; some varieties have very distinct brownish-yellow crossbands at its base. Just the same varieties occur in the colouring of the fly *E. tenax.*

The fly appears in great abundance principally in autumn and, when the days become chilly, in a semi-torpid state, either sucking flowers, or crawling slowly upon walls and fences. The American observer, just quoted, is probably right in attributing to them a useful part in the fertilization of composite flowers, and here we come across a most refreshing instance of Anglo-saxon enterprise, an attempt at once to utilize this fertilizing quality of the fly. The following notice speaks for itself. („*Insect-Life*", April 1893 which, by the way, I received just as I was giving the finishing touches to the present article). Complaint being made about the non-seeding of the *Chrysanthemum* in Jamaica, Mr. F. D. A. Cockerell, Jamaica writes: „It seems that if *Chrysanthemum*, which flourishes well in our mountains, could be got to seed, a profitable industry might be carried on, the seeds being of high market-value. It at once occurred to me that our want of *Eristalis tenax* might explain the non-seeding, and the question has arisen „*shall we not import that fly?*" etc. (1).

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(1) John Hamilton. M. D. has an interesting article: „On the probable pollenization of greenhouse *Chrysanthemums* by *Eristalis tenax* in: *Entomologica Americana*, Brooklyn, N. Y, VI, p. 81, 1890. The author is inclined to ascribe to the Chrysanthemum-craze, which prevailed in the United States for some time, some influence in the rapid propagation of this species in that country. It was always very abundant in greenhouses.

The larva of *E. tenax* is the well-known *rat-tailed larva* (*ver à queue de rat*, so called for the first time by Réaumur IV, p. 443); it is figured in the same volume, plate XXX. A long tail, with a telescopic arrangement for prolonging or shortening it, enables the larvae to live several inches deep in the water and to pump air from the surface. They frequent putrid waters, sewers etc. and crawl out of them to change into pupae in the vicinity. The vitality of these larvae is said to be extraordinary, and for this reason Linné gave it the name *tenax*: „Habitat in fimetis, cloacis, aquis putrescentibus vix prelo (1) destruenda larva" (Linné, Syst. Nat. XIIth edit. p. 984, 1766). Kirby and Spence (vol. IV, p. 189) say: „an inhabitant of muddy pools, it has occasionally been taken up with the water used in paper-making, and, strange to say, according to Linné (*Fauna Suecica*) resisted without injury the immense pressure given to the surrounding pulp; like *leather-coat Jack*, mentioned by Mr. Bell (Anatomy of Expression in Painting, 170), who, from a similar force of muscle, could suffer carriages to drive over him, without receiving any injury." Geoffroy (vol. II, p. 521, 1762) repeats the same story: „This larva also occurs in the pulp of rags from which paper is made: when this pulp is beaten for the manufacture of paper, the larva although badly struck by the hammers, is not crushed, but survives and produces a fly. This fact would seem incredible, if it was not affirmed by the great Naturalist." (2)

This tenacity may have been the cause of the success of this fly in the so-called struggle for existence. It has attained an almost universal distribution, and the progress of civilization has only increased its opportunities. In ancient times it had to look out for stray carcases. Civilization offers it its drains, canalizations, cesspools and dung-heaps in which it can wallow in abundance, and perhaps better protected against possible enemies. Different in this from other kinds of insects, which disappear with the culture of the land, *E. tenax* thus gained a new impulse, and spread in new countries with an astounding rapidity; it entered into a kind of commensalism with man, like the *Musca domestica*, *Teichomyza fusca* and some other dipterous insects, which are at present hardly found anywhere, except among human habitations. It is very rare now to come across a carcase, and to see *E. tenax* hovering about it; the only instance I have found in the literature consulted by me concerns another species of *Eristalis*, *E. anthophorinus* Zett., and that case occurred in a distant and primitive country. Zetterstedt, (Dipt. Scand. II, 666) being in Lapland, observed a small swarm of flies of this species round the carcase of a sheep. I shall give the detail of this observation in the Supplement VII.

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(1) (*Translation.*) „Lives in dungheaps, cesspools, putrescent waters; a roller even will not kill it."

(2) In H. O. Lenz's: Gemeinnützige Naturgeschichte. Gotha, 1836, Vol. III, p. 490, (by the way, an excellent old book, full of original observations) the author calls in doubt these stories about *E. tenax*, and probably with good reason.

In an article entitled: „Facts concerning the importation or non-importation of Diptera into distant countries“ (Trans. Ent. Soc. London 1884, p. 489—496), I have shown that we know very little about the laws which govern this class of phenomena; that importations will occur against all probability, and that, on the contrary, other importations which appear to us easy and probable, do not take place during centuries of intercourse. Since publishing this paper, I found in Darwin's „*Life and Letters*“ vol. II, p. 243, in a letter of his to J. D. Hooker, the following passage which expresses the same idea: „Now I maintain against all the world that no man knows anything about the transoceanic power of migration“ etc. Without entering into the detail of this question, which is foreign to my present purpose, I will merely show the very interesting circumstances of the immigration of *Eristalis tenax* into the New World.

Before 1875 *E. tenax* was known to occur in the temperate regions of the old world only. With the exception of the East-Indies, the Austro-Malayan Archipelago, and the greater part of Africa, including South Africa, about which I have no data, it has been reported from the whole of Europe, as far north as Lapland, from Northern and Central Asia, beginning with Syria and Persia, through China to Japan (1), from North Africa (Algiers) and from the islands surrounding Africa (Madeira, the Canary Islands, and, on the eastern side, Madagascar and Bourbon). During my twenty years of residence in North America, spent in collecting diptera and receiving collections from many other entomologists, I never met with a specimen of *E. tenax*, until Nov. 5th 1875, when, to my great astonishment, I found one on a window in Dr. Hagen's house in Cambridge, Mass. A year later (Oct., Nov. 1876), I observed several specimens on the fences of Newport, R. I. In June 1877, I sailed for Europe, but I heard afterwards that during the same year the fly had become so common, that „hundreds were caught." A few years later, the species was reported from nearly all the States of the Union, including California and Washington Territory; also from Canada (Montreal, common, as stated by Mr. Caulfield in Canad. Entom. 1884, p. 138).

A communication made by the american Dipterologist Dr. Williston (Synopsis of the N. Am. Syrphidae 1886, p. 161) proves that the invasion has gone, not from the Atlantic border to the West, as one might have expected, but on the contrary, from West to East. Dr. Williston had seen a specimen of *E. tenax* hidden among a lot of duplicates in Prof. Riley's collection, bearing a label S. Louis, August 1870. Upon drawing Prof. Riley's attention to the fly (which the latter did not previously know by name), he was assured that the species had long been familiar to Mr. Riley in outhouses about S. Louis. The surprising rapidity, however, with which the species spread along the Atlantic coast, soon after its first appearance, renders it probable that it cannot have existed in S. Louis very long before 1870, otherwise it would have reached the Atlantic sooner. We are thus driven to accept the following outline of its history: We know that it exists in Japan and Eastern Siberia; from there it must have migrated to the North American Pacific Coast, perhaps long ago. It did not spread eastward at once, because the necessary conditions for its existence were wanting on the immense plains it had to cross, just as the Colorado beetle lived in the Rocky Mountains on *Solanum rostratum*, and did not spread eastwards until civilization brought the potato-plant (*Solanum tuberosum*) with it, and thus bridged over for that beetle the distance between its native mountains and the Atlantic coast. The condition which civilization brought, and which favoured the rapid eastward progress of *E. tenax*, consisted in the drains, sewers and cesspools, those necessary concomitants of crowded centres, and the usual abodes of the larva of *Eristalis* (1).

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(1) The occurrence of *E. tenax* of Japan is of very long standing. An Encyclopedia, compiled in 1713 contains a mention of the fly and its larva, „living in ordures", which proves that the people did not confound it with the bee. They called it „bunbun", from the humming sound it produces. (Communication of Mr. Kumagusu Minakata *in litt.*; compare above, p. 20.)

Mr. F. L. Arribalzaga, in Buenos Ayres, informs me (Nov. 1893) that this species has not been found in South America yet. The immigration of *E. tenax* into New Zealand is of a still more recent date than that in North America. The Catalogues of the N. Z. Diptera by Nowicky (1875) and Professor J. W. Hutton (1881) do not mention it. It was first noticed in Wellington (North Island) in October and November 1888. In June 1890, Mr. W. W. Smith (Ashburton, South Island) writes:

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(1) All the details and references about the geographical distribution of *E. tenax* will be found in my two articles:

1. Facts concerning the importation or non-importation of Diptera into distant countries (Trans. Ent. Soc. London, 1884. p. 489—496);

2. Some new facts concerning *E. tenax* (Entom. Monthly Mag. London, XXIII, p. 97—99; 1886).

Since the appearance of *E. tenax* in North America it has been discovered that it is already subject to the attack of a parasite. The Proctotrypid *Tropidopria conica* Fab. has been bred from it. (Comp. Ashmead, North American Proctotrypidae 1893, p. 418.) It is a European insect „now widely distributed in North America and probably imported with its host.“

„it is now widely dispersed and very plentiful in the South Island." (Notes on *E. tenax* in New Zealand by W. W. Smith, in the Entom. M. Mag. London, 1890, p. 240—242.)

From this article I borrow the following passages:

„How long before the spring 1888 the species was introduced into these islands I cannot say; it certainly could not have been many years; but the two previous seasons were most unfavourable for its increase, being for the most part very wet and windy; since then we have been favoured with exceptionally good seasons . . . ." „The two hot, dry summers in succession, with the intervening mild winter, produced, no doubt, the natural conditions for its complete and rapid establishment in N. Z.; I am supported in my views by the unpleasantly numerous cases of typhoïd, dysentery, diarrhoea, and of course, the inevitable „*Grippe*"; the presence of these diseases betokens also the presence of the natural conditions requisite for *E. tenax*, viz.: stagnant pools, ponds, drains and sewers etc., caused by the abnormally dry season, while the creeks and rivers have not been so low for twenty-seven years . . . ."

„I have endeavoured to show what appears to me to have been the chief cause of the irruption of *E. tenax* in N. Z. 1890; it however leaves unexplained how and when the species was introduced; but in the absence of positive proof, I think it probable that it came to N. Z. from the Pacific coast; the numerous intervening groups of islands would provide a ready means of dispersion, if the necessary condition for its larval stage existed in the islands; nevertheless, I think that in all probability it was imported direct by the mail-steamers which have plied monthly between S. Francisco and Auckland for the last twenty years; from this source unquestionably came *Carpocapsa pomonella* (1) in imported apples to N. Z.; possibly we may soon have records of the occurrence of *E. tenax* in other islands of the Pacific."

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(1) A small moth which infects apple-plantations.

A short notice, published by the same author two years later in the Entom. M. Mag. London, 1892, p. 110, may likewise be reproduced here:

„This fine mimicking Dipteron is not quite so numerous in this district this season as it was at this time last year. I think it may in some measure be due to the greater rainfall of last winter, in flushing the stagnant and swampy pools where the larvae chiefly exist. I was lately at a woolscouring works half a mile from Ashburton, and observed the larvae in hundreds swimming about in the fat-barrels. Some of the latter had remained where they stood for years, and were filled with a thick, black, strong-smelling liquid; the larvae however appeared to thrive well in the atrocious stuff.“ W. W. Smith, Ashburton, New Zealand, Jan. 5, 1892.

It is singular, and suggestive of reflection, that two continents, nearly antipodal, should have been invaded by *E. tenax* almost simultaneously, that is, within an interval of less than twenty years. This simultaneousness becomes still more significant when we contemplate it in contrast with the totally different circumstances under which the invasion took place on either side. In North America, during four centuries of constant intercourse with Europe, not a single specimen of *E. tenax* seems to have been imported to the eastern coast of the United States. The invasion came overland from the West, a region from which it hardly could be expected. To New Zealand, on the contrary, *E. tenax* has been imported after a comparatively short period of colonization and, in all probability, „direct by mail steamers which have plied monthly between S. Francisco and Auckland for the last twenty years“ (see above p. 35). The distance from Liverpool to New York is about 3200 miles; that from S. Francisco to Auckland must be more than twice as long. (1) This great disparity of results, obtained under almost identical circumstances, is as yet an unsolved problem.

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(1) I have no data at hand, but judge by the length of the average passage of steamers. The distance from S. Francisco to Brisbane is, as far as I know, 7000 miles.

According to an account which I received this spring from Mr. F. A. A. Skuse in Sydney, the invasion into Australia has not taken place yet. A notice published by him a few years ago in his „Notes on the known dipterous fauna of Australia,“ (in the Trans. Australas. Assoc. for the Adv. of Science; Melbourne meeting, 1890) refers to a single specimen said to have been found in New South Wales, the identification of which however still requires confirmation.

Except the silkworm and the honey-bee (1), I hardly know of any insect that can show an historical record equal to that of *Eristalis tenax*. The record begins in the dusk of prehistoric times, and continues up to the present date. In its earliest days *E. tenax* appears like a myth, a misunderstood and unnamed being, praised for qualities which it never possessed, a theme for mythology in prose and poetry; later on, the bubble of its glory having burst, it gradually settles into a kind of commensalism with man, it obtains from him „a local habitation and a name,“ it joins the Anglo-Saxon race in its immense colonial development, it vies with it in prodigies of fecundity, and at present renders hitherto unrecognized services in converting „atrocious stuff“ into pure and clean living matter! (2)

(1) I cannot refrain from introducing here a very interesting passage from a letter of Mr. Kumagusu Minakata. He says that my comparison of the historical record of *E. tenax* with the honey-bee and the silk-worm may be true „as far as Western records are concerned“: to him it seems that, „as well as these insects, the ant, the cicada, the glow-worm and the cricket, are very early recorded in the writings of the Chinese; while the one most anciently referred to in the history of Japan, is probably the Dragon-fly, after which the first Emperor Jimmu named his empire „the region of the Dragon-fly“, as early as 630 B. C.“

(2) La plupart des larves de Diptères, destinées à passer leur vie dans des foyers de décomposition animale ou végétale, impriment à ces éléments putrides qui leur servent de nourriture une existence vitale en les faisant passer pas les filières de l'organisme. Cette sorte de métempsycose, passez-moi le mot, épure l'atmosphère des atomes délétères qui la rendraient impropre à la respiration.

I close this chapter on the Bugonia-craze with the moral of it, contained in another sentence from Goethe:

„Man sieht nur was man weiss.“ (1)

C. R. Osten Sacken.

C'est là, au point de vue philosophique, le service inaperçu rendu à l'humanité par les larves immondes qui grouillent dans l'ordure et la corruption. Telle est la mission d'hygiène publique dont la coopération est positive pour le maintien des lois qui régissent la nature organique. (Léon Dufour, Ann. Soc. Ent. Fr. 1864, p. 615.)

(1) We see only what we know.

SUPPLEMENTS.

I.

Analysis of the process of the ancients for breeding oxen-born bees.

The most complete account of the process, with all its latest improvements, used by the ancients for the artificial production of oxen-born bees from carcases, is that described in the *Geoponica* (Comp. about it my *List of authorithies*). (1) In this work, the chapter on bees (XV, 2) is connected with the name of Florentinus. The principal feature of the process is a hermetically closed shed, and in this particular the process agrees with those that were recommended by much older authors, Democritus and Varro, and also, as I shall show below, with the poetic version of Virgil. At the same time other processes are mentioned by ancient authors, in which, instead of receiving an artificial covering, the dead ox was simply buried underground: either the whole ox (Antigonus Carystius, quoted on p. 21: the passages of Ovid, Met. XV, 365 and Fasti, I, 376, reproduced on p. 6 and 22), or only a portion of the ox, principally the paunch (Mago, quoted by Columella, comp. Suppl. X);

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(1) The Greek text of the Geoponica, is accompanied by an old Latin translation. Aldrovandi, p. 58—59 reproduces the description of Florentinus's process in this Latin version, but with some important omissions and verbal changes.

sometimes with the addition of dung (Pliny XI, 20, comp. p. 22) (1). The feature common to all these processes is the exclusion of the carcase from the open air.

There is little doubt that, under favorable circumstances, the oxen-born bee (*Eristalis tenax*) could be obtained by all these processes (the sneers of Redi notwithstanding, comp. p. 24) but I shall confine myself to the examination of the account in the Geoponica, which is detailed enough for a scientific analysis. At first sight, nothing seems to be more preposterous than the account of Florentinus; but a close criticism soon reveals that the process must have been the result of experiments which may have been repeated for centuries, and resulted in the end, as I shall endeavour to prove, in a very rational method for obtaining *Eristalis tenax*.

The account begins thus: „Juba gave directions for breeding bees (apes facere) in a wooden box (arca lignea): but Democritus and Varro (2), the last writing in Latin, report that they were bred in a house, which is the better way (quid etiam melius est)."

„Build a house (3), ten cubits high, with all the sides of equal dimensions, with one door, and four windows, one on each side; put an ox into it, thirty months old, very fat and fleshy; let a number of young men kill him by beating him violently with clubs, so as to mangle both fleesh and bones, but taking care not to shed any blood; let all the orifices, mouth, eyes, nose etc. be stopped up with clean and fine linen, impregnated with pitch; let a quantity of thyme be strewed under the reclining animal, and then let windows and doors be closed and covered with a thick coating of clay, to prevent the access of air or wind. Three weeks later let the house be opened, and let light and fresh air get access to it, except from the side from which the wind blows strongest. After eleven days you will find the house full of bees, hanging together in clusters, and nothing left of the ox but horns, bones and hair, etc."

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(1) The silence of Pliny about Aristotle in this instance, already noticed by Aldrovandi, is significant, because at his time he must have had access to many of Aristotle's works which are now lost. From the non-committal attitude of Aristotle with regard to the Bugonìa it may perhaps be inferred that he never has had the opportunity to investigate a case of it. If he had been in the position to refute it by showing that the pretended oxen-born bee was not a bee, but a two-winged fly, he would have probably mentioned it in one of his works. As the case stands, it would seem that he considered it as a superstition not deserving any notice.

(2) This refers to some passage of Varro which is no longer found in his works (Remark in John Conington's Commentary on Virgil, I, 356).

Democritus is not the philosopher, but some obscure writer sometimes called the *false* Democritus (Comp. Voss, in his translation of the Georgica p. 280).

(3) For house, oikos, the commentator Conington has *chamber*. This passage has already been given on p. 7—8; I reproduce it here for the sake of easier reference.

It is the hermetic shutting up of the house, or shed, which was principally ridiculed by Redi (Esperienze etc. p. 57), who observes, with apparent good reason, that putrescent matter, shut off in that way, would produce nothing; but that on the contrary, when exposed in the open air it would attract flies, and breed worms. And yet, this very peculiarity of the process, as I am going to show, is the best means for obtaining the oxen-born bee, because it happens to agree with its peculiar habits of life. The larva of *Eristalis* being aquatic, requires a pool of stagnant water, containing putrescent organic matter. A carcase, left in the open air, is at once attacked by the ordinary carcase-loving flies, *Lucilia*, *Calliphora* etc. During the second stage of putrescence, a pool of corrupt water is formed about the carcase, and then is the time for *Eristalis* to appear (comp. the description of Zetterstedt in Suppl. VII). In climates, like those of Italy and North Africa in which dry summers prevail, dessication goes on rapidly, and the carcase might easily dry up before reaching the second stage. The process of the Geoponica is calculated to delay that dessication as long as possible: at the same time it has the advantage of shutting out the *Luciliae* and *Calliphorae*, unnecessary for the purpose in view. The shutting up is therefore, in this case, perfectly rational; in excluding these flies it could not exclude *Eristalis tenax* which, as our experience with canalizations etc. teaches us, is impelled by instinct to crawl into dark places. The details of the process: the mangling of flesh and bones to make them softer, and their putrefaction easier: the care taken not to shed any blood (1), and stopping up, for that purpose, all the orifices of the body (blood being so much moisture) etc. — are as many precautions to prevent dessication and to quicken as much as possible the process of decay. After three weeks of seclusion, the opened shed would contain nearly full-grown larvae. The fact of not seeing the flies enter, and then finding living larvae in that closed room, naturally confirmed the people's belief in spontaneous generation. I introduce here the continuation of Florentinus's account (which, for brevity's sake, I had omitted before, on p. 8): „When the shed is opened, small white animalcules are seen, resembling each other, motionless; then they are observed to grow little by little, to develop wings, and to take the color of bees; the wings are at first short and tremulous, unfit for flight, the limbs are weak: finally desirous of light, the insects start and knock against the windows, pushing each other."

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(1) „Florentinus particularly insists that no blood is to be drawn, a pro-

I omit a passage about the king, emerging from the brain, the other flies crowding about him etc., evidently superfetations suggested by the recollection of the behaviour of swarming bees.

Virgil's description of the process agrees in the main with that of the Geoponica. The long episode of Aristaeus (Georgica IV, 281—558) (1) consists of three parts. In the *first* (v. 281—314) Virgil announces that in case of some disaster with the bees, and when there is no prospect of obtaining a new brood (v. 281—282), then is the time to reveal (pandere) the glorious art of the Arcadian master Aristaeus, by means of which bees have often been produced from the putrid blood (insincerus cruor) of slain oxen (v. 283—285). He intends to tell the whole tale from its very beginning (v. 285). The invention was discovered in Lower Egypt, and the whole country

hibition which Virgil seems to have forgotten when in verse 542 he makes Proteus tell Aristaeus to cut the throats and the bullocks for that purpose." (J. Conington, Commentary on the Georgics I, 357).

(1) For all the quotations from Virgil I use the edition of Ribbeck. A translation of this passage of Virgil by the poet Rucellai will be found in Redi, p. 54.

relies upon it for its safety (v. 294 „omnis in hac certam regio jacit arte salutem"). Then follows the description of the proceedings, the choice of the locality, the building of a shed (the commentator Conington calls it *chamber*) with four windows, the slaying of the young ox, the pounding of his flesh without shedding any blood, the stopping up of all orifices, the strewing of thyme and casia etc. (v. 295—304). This takes place in the early spring before the swallow builds its nest (v. 307). Now begins the seething of the sap, and singular animals appear, at first without legs, but soon with vibrating wings, forming a swarm which rises into the air, and is compared to a rain-shower, or to the arrows of Parthians in battle (v. 309—311):

> Visenda modis animalia miris.
> *Trunca pedum primo*, mox et stridentia pinnis,
> Miscentur, tenuemque magis magis aëra carpunt.

Joh. H. Voss translates it:

> Aber die gährenden Säft' erhitzt im zarten Gebeine
> Sieden indess, und man schaut ein wundersames Gewimmel
> Mangelnd an Füssen zuerst; doch bald mit schwirrenden Flügeln
> Schwärmt es, je mehr und mehr zur dünnen Luft sich erhebend.

Commentators and translators must have been puzzled by the expression „trunca pedum primo", „at first deprived of legs", which, of course, refers to the larvae (1).

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(1) In an old Latin dictionary which I possess (Ambrosii Calepini Dictionarium etc. Venetiis 1559, apud Paulum Manutium, Aldi filium) I find under the vocable apes, the following curious reference to this passage of Virgil: „Compositum putatur ab ἀ, *sine*, et *pes*, quod sine pedibus nasci videatur, dicente Virgilio : *Trunca pedum primo.* Sed quam non servet analogiam, sicut caetera composita : Bipes, tripes, compes : magis simplex judicandum est. Apes ex bovum fimo, sicut crabones ex equorum, fuci ex mulorum, vespae ex asinorum excrementis."

Robert-Tornow (p. 24) quotes a similar ridiculous derivation of *apis* by a Dr. Kilmarus, in a dissertation *de jure apum* (edit. II, 1686 A. D.): „Apes vel apis ex ἀ καὶ ποῦς, quod sine pedibus nascuntur. Virg. trunca pedum etc." Calepinus's derivation is more than hundred years older, and both must have come from some common source.

O Muse, asks Virgil, what deity has taught us this art? (v. 315). And now begins the *second* part of the episode, the long story how Aristaeus learned the secret (v. 316—547). — It is unnecessary to repeat it here, as I have given it in a few words before (p. 20).

The *third* part is quite short; Aristaeus follows the advice he had received, builds the required altars (v. 549), immolates eight oxen, and after *nine* days, returns to the place and witnesses the performance of the miracle: the softened entrails of the oxen teem with bees, who rush through the broken ribs (v. 555—556), get upon the trees, and hang on to the branches (v. 557—58).

In one point Virgil is mistaken and must have misunderstood his informer:. the *nine* days required for the process: Florentinus says *thirty-two* days, which, as I am going to show, is the time necessary for the development of *Eristalis* from the egg to the imago. *Nine* days are just sufficient for the pupa state only.

Redi (p. 58) notices a contradiction between verses 296—298 of Virgil, where shed, roof, four windows etc., are mentioned, and verses 538—543, where such a mention is omitted. But this *omission*, does not, it seems to me, involve a *contradiction*. In the first passage Virgil is merely didactic, and explains the detail of the process to the reader; it was therefore not necessary for him to repeat these details in the second passage, in which he closes the episode of Aristaeus with a poetic peroration. Aldrovandi (p. 59) notices the close resemblance of the accounts of Virgil and Florentinus, and, after reproducing the latter, almost *in extenso*, observes „that nearly all this is contained in the verses of the prince of latin poets, Virgil“ (quae fere omnia his versibus complexus est poetarum princeps Latinorum Virgilius), and then introduces the corresponding passage of the Georgics, IV, v. 231—314.

The time allotted by Florentinus for the whole operation (thirty-two days; twenty-one with the doors shut, eleven with the doors open) agrees quite well with the time required for the development of *Eristalis tenax* from the egg to the imago. I did not find, in entomological literature, any statement about the number of days required for the whole development, but I found several statements about the pupa-state. Réaumur (IV, 471) says it is „eight to ten days, when the weather is favorable.“ Swammerdam (p. 257 Germ. ed.) says 16—17 days; Taschenberg (in Brehm's Thierleben, IX, p. 467) — from 12 to 14 days; Letzner (Schles. Ber. 1856, p. 117) — 13 days. Deducting the eight or ten days of Réaumur (as better adapted to a warmer climate than the other statements) from the thirty-two of Florentinus, twenty-two or twenty-four days remain, which is time enough for the development of egg and larva.

I sum up my analysis of the Bugonia-process of the ancients and, in general, the history of this superstition, as follows: For centuries the ancients have made efforts to obtain oxen-born bees by artificial processes; Florentinus (comp. p. 6) calls it „making bees“ (apes facere), which may have been a current expression; the essential feature of all these processes consisted in the *isolation* of the whole carcase, or of a portion of it, from the open air. The result obtained were legless larvae, which, after a time, changed into bee-like insects; but as larvae of bees cannot live in rotten matter, the insects into which they changed could not possibly have been honey-bees; they were bee-like flies, drone-flies, *Eristalis tenax*, the only flies which have the required qualifications for playing the part of oxen-born bees (comp. p. 9). The ancients always mistook them for real bees, and *never became aware that they did not get any honey from them.* The assistants of the experiment let the flies loose, feeling satisfied with having increased the number of „flower-sucking bees, mothers of honey,“ who „like their forefathers roamed over pastures, bent upon work and hopeful of the future“ (Ovid. Metam. XV, v. 366—68; comp. p. 6 for the whole passage).

That this illusion lasted so long, and that the ancients never came to distinguish *Eristalis* from a honey-bee, was principally due to that form of mental inertia, which, at the very beginning of my essay (comp. p. 5) I have called *routine*, (which may be intellectual or sentimental), and to which, under certain circumstances, the best intellects are apt to succumb. Single individuals may have noticed, at times, the difference between oxen-born bees, and real honey-bees, but such insolated instances of perspicacity do not seem ever to have taken the shape of a *generalization*, like that which Aristotle had formulated centuries before, in defining the difference between four- and two winged insects.

Whether experiments to „make bees“ were continued through the middle-ages is not apparent, at least I have not found any positive testimony about it; it seems more probable that the superstition was propagated among scientific men on the authority of the ancients, and by tradition among the rest of the people; it may even have originated spontaneously in different places at the aspect of bee-like flies, swarming round carcases.

The final extinction of this superstition was due to two different causes (comp. p. 4):

1. Scientific men (principally Harvey and Redi) adopted the theory: *omne vivum ex ovo*, which put an end to the belief in spontaneous generation. This progress however did not prevent some very learned contemporaries (like Bochart and de Mey) from upholding the old belief, on the authority of the ancients.

2. Improvements in the sanitary police, in civilized countries, brought about an early removal of carcases, and thus prevented the crowd from witnessing the spectacle of bee-like flies swarming about them. But in distant countries, where there is no police, the superstition may still be flourishing.

The recognition of *E. tenax*, as being different from a bee, came about gradually, in the second half of the seventeenth century, through the efforts of *Clutius*, *Goedart*, *Blankaart* and *Swammerdam* (comp. p. 10—13) but the final identification of this fly with the oxen-born bee, was due to Réaumur in the next century (comp. p. 14). This identification however was entirely overlooked in all literature, until I happened to hit upon it, independently of Réaumur, during my studies on diptera. That J. H. Fabre, the eminent observer of insects, was, contemporaneously with me, of the same opinion, appears from his calling *E. tenax* by the name of „l'abeille Virgilienne“, *the virgilian bee*, without any further comments, as something self-understood (J. H. Fabre's Souvenirs entomologiques, Vol. IV. p. 260; 1891; comp. above, p. 15).

II.

The Bugonia from a psychological point of view.

Hitherto I have attempted to explain the long duration of the Bugonia-craze from the intellectual point of view only (that is, as far as it was due to a want of *knowledge*); but it is well-known that, in matters of superstition, sentimental motives exercise a considerable influence. In order to understand and to appreciate such influences, I shall introduce, for comparison's sake, a short account of a very remarkable superstition which has prevailed for several centuries in central Europe.

I quote from Henri Martin, Hist. de France, VII, p. 265: „André de la Vigne in his *Journal of the journey of Charles VIII* of France, relates that the King touched and cured in Rome about *five hundred* persons afflicted with scrofula. The pretension of the Kings of France to cure this disease, in virtue of a miraculous privilege attached to their coronation and anointment, is one of the most singular passages in our history. The origin of it is unknown: it existed already in the XIth century, and all our old historians, and especially the official chroniclers, make frequent allusions to it, as to an incontestable fact. Scrofulous diseases do not number among those that may be cured by a sudden act of the imagination, or of the nervous system. But monarchic and national pride contributing, nobody dared to doubt of a prerogative so honorable to the crown. The Kings of England had the same prerogative, without any doubt equally well founded.“ And even now, the popular name for scrofula in England is „the Kings evil.“

The words of Henri Martin: „monarchic and national pride contributing“, suggest the idea that the craze of the Bugonia may also have been fostered by some similar sentimental motive. From the existing records, we may describe this motive as follows: All nature, for the ancients, seemed permeated with Divinity, and in this universal deification — oxen, bees and honey are treated with a particular tenderness, and often connected with feasts, altars and Divinity itself. I have quoted from Aelian, a passage in that sense, which I have chosen for the motto of the present essay. The episode of Aristaeus, already referred to by me, is replete with the same spirit. And the same is the case with the passage from Varro (de re rustica, II, 5), which I have reproduced on p. 21.

The book of Robert-Tornow, De apium mellisque apud veteres significatione et symbolica et mythologica etc. 1893 (compare my *List of authorities)* was written for the very purpose of illustrating this particular feature of the life of the ancients, and contains a multitude of illustrations about the sanctity of bees and honey (1).

This suggestion of a sentimental side of the Bugonia, as partly explanatory of the persistency of the craze, I offer only tentatively, without attaching much importance to it. My principal object in bringing forward the mediaeval superstition was to show that the depth of human credulity is unfathomable, and that the Bugonia of the ancients was by no means the most grotesque exhibition of it. On the other hand it would carry me too far to examine human folly, and illusions in general, in the light of essential ingredients of human hapiness. Erasmus of Rotterdam has written a celebrated book on this subject, the deep and true meaning of which has not yet, it seems to me, been sufficiently appreciated. „Si la raison dominait sur la terre, il ne s'y passerait rien,“ said one of the cleverest of Frenchmen (1).

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(1) Tornow mentions among others the celebrated rhetorician *Libanius*, contemporary of emperor Julian (4th century A. D.) as having composed a book „Bovis laudes“, (The praise of Oxen) in which he also speaks of the honey procured from them.

Since the fall of the Roman Empire, during the whole of the Middle Ages, up to the second half of the XVIIth century, the perpetuation of the belief in the Bugonia among the educated classes was likewise the produce of a two-fold influence: an intellectual deficiency, and a sentimental bias; the former consisted in the confusion between bee and fly; the latter in the immoderate and irrational worship of the ancients, which for a long time has hampered the acquisition of knowledge. I cannot do better than introduce on this subject a chapter from Réaumur, the man who more than anybody else contributed to the confutation of all superstition in matters of science. He combined the gift of a marvellous closeness of observation, with an indomitable logic, and a delightfully transparent style of writing. To those who understand French, I recommend the following chapter in the original; to those who do not, I offer my feeble effort at a translation.

III.

On the gradual revival of Natural Science in the XVIIth and XVIIIth centuries; a chapter translated from Réaumur, Mém. etc. Vol. I, p. 28—31 (1734).

During the long succession of centuries when barbarism reigned supreme, Natural History shared the fate of all other sciences; as soon however as the taste for knowledge began to revive, the study of nature was likewise taken up. It was believed at that time that every kind of truth could be recovered in the writings of the ancients, that the ancients knew everything, understood everything. The history of animals was principally studied in Aristotle. If Aldrovandi, Gessner, Moufet and so many others, instead of devoting so much time to the study of ancient naturalists, had studied nature itself, the patient labour of these sound intellects would have been better rewarded by an increase of knowledge. The observation of nature seemed for them to have no other aim, than to confirm what had been found in the ancients. It was as if the modern generation was considered incapable of thinking for itself, or of seeing anything but what had been seen before. One should think that, on the contrary, if there are any sciences in which we can, and ought, to surpass the ancients, it is in the sciences of observation.

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(1) Fontenelle, Dialogue de Démétrius et d'Hérostrate.

By and by, however, nature opened the eyes of those students who, until then, had sought in her but what they had read in Aristotle and Pliny; they became aware of the existence of some facts which were worthy of notice, although they were not found in those old books supposed to contain everything; they perceived other facts which provoked in them a well-founded mistrust in that which they had received from tradition. Thus the implicit trust in the ancients became gradually, and sometimes unnecessarily, weakened, and people began to realize that it was indispensable to study nature itself, to verify what had been taught before, and to attempt to acquire new knowledge. This was the course adopted by Malpighi, Swammerdam, Redi, and other illustrious men, either contemporaries, or of more recent date. Even those who, in consequence of a perhaps fortunate ignorance, were incapable of reading the ancients, like Goedart and Miss Merian, have contributed their share to the good work.

The first, and one of the most important steps which had to be taken in the history of insects, consisted in dispelling the false notion which the ancients had entertained about the origin of most of them, when they believed that insects could be bred from putrescent bodies of different kind. This step, which seems so easy, proved nevertheless to be very difficult, and showed how anything to our minds, may become an obstacle. Preposterous as it seems to attempt to breed honey-bees from the flesh of rotten calves and oxen, wasps and hornets from that of rotten horses, and beetles from that of asses; foolish as it appears, to believe that an infinite number of other insects are produced from cheese, from different plants and even from mud; it has required a great deal of observing and of reasoning before it became possible to confute these absurdities. Even in our days, some men, illustrious by their learning, were possessed by such vagaries; for instance the famous Father Kircher and Bonnani, although natural history owes a great deal to them. As late as 1717 a work was published in Venice, entitled: *Motivi di dubitar intorno la generazione de' viventi secondo la commune opinione de' Moderni*, in which an attempt is made to resuscitate the old error.

It is a matter of surprise that such ideas should have continued to prevail at a time when students had already begun to consider with a philosophic eye the smallest of insects. They must have soon become aware that the mechanism of the different organs which constitute the body of a moth, is not less complicated than that which is found in the body of an elephant. Philosophy must have taught them that the conceptions of great and small exist in our minds only, and in relation to ourselves, and that, for this reason, the structures of almost imperceptible insects are in reality just as admirable as those of animated masses of colossal size. The evolution of the smallest animalcules requires as many preliminary processes as that of the largest animals. And it is just as ridiculous to believe a fly to be born from a rotten carcase, or an oyster from a handful of mud, as to expect an ox, or an elephant, to emerge from a rotten haystack!

As long as nature had not been sufficiently studied, those who saw worms crawl out of decaying flesh, quite naturally believed that these worms originated in it. The observations made by Redi, and lately by Leeuwenhoeck, curious in themselves, were indispensable for enlightening those, whose mind could only perceive what was conveyed to it by their bodily eyes („dont l'esprit ne voit que ce qui lui a été transmis par les yeux du corps“). And nothing proves better how difficult it was to demonstrate that the smallest animals are born exactly in the same way as the large ones, than the error in which, to the shame of human intellect, Redi himself has fallen, when he found it necessary to explain the appearance of insects in the galls that occur on certain plants and trees, by the hypothesis of *a soul* in those plants, which he had invented for that purpose; he, the declared enemy of superstition, and who knew so well how to refute it!“ (Réaumur alludes here to the passages on pages 109 and 113 of Redi's Esperienze etc.; pages 234—244 of the Latin translation; comp. the next Supplement.)

IV.

The inconsistency of Redi, in regard to the principle: omne vivum ex ovo.

The learned Parisian professor Peter Gassendi (1592—1658) „quel sublime scrittore, quel fulgidissimo lume delle scuole moderne,“, as Redi, somewhat ironically, calls him, attempted to explain in the following fashion the use of thyme and cassia, recommended by Virgil and Florentinus for the process of the Bugonìa: These plants contain, according to Gassendi, seeds, most prolific of bees („semi abilissime alla generazione delle pecchie“); their perfume penetrates the carcase, and predisposes the rottenness to assume the shape of these industrious animalcules! („penetrando nel fracidume di quel cadavero, lo dispongono a vestir la forma di quegl'industriosi animaletti“).

Redi receives this explanation of Gassendi with his usual sneer, and yet, such is the weakness of the human intellect, that the same Redi, instead of consistently maintaining the principle *omne vivum ex ovo*, uses precisely the same hypothesis as Gassendi in a case where his powers of observation failed, and the principle seemed inapplicable. His intellect was staggered by the difficulty of explaining the existence of live worms within hermetically sealed galls on plants, and he at once jumped at the conclusion that there is a certain *soul* in plants, which evolves those worms, just at it produces flowers and fruits! (Compare, Redi, Esperienze etc. p. 109—113). And, instead of trying to verify this hypothesis by observation and experiment, he uses, in support of it, the very same kind of arguments which he ridiculed in other authors, such as references to ancient writers, and superficial reasoning. Réaumur denounces this failure of Redi at the end of the chapter translated by me in Suppl. III.

V.

Why ancient writers, in so many passages concerning the Bugonia, derived the origin of hornets from carcases of horses and confused them with wasps.

The earliest passage I know of, alluding to the connection of wasps and hornets with carcases of horses, is a fragment of an epigram of the poet Archelaus, quoted by Varro: *the horse produces wasps, young bullocks — bees* (compare above, p. 22, also Suppl. X, under Archelaus). Ovid, Nicander, Pliny, Aelian, Galen, Plutarch, Origen and Cardanus may be also quoted in this connection; (comp. Suppl. X, under these names). But it is evident that among these authors a confusion prevails between *wasps* and *hornets*, and Redi does not fail to laugh at it (comp. p. 24). I venture the following, very simple, explanation (I have already given it, in abstract, on p. 15): There is a genus of flies, commonly called *gad-flies* or *bot-flies (Gastrophilus)*, the biology of which is closely connected with the equine family, horses and asses. The flies deposit their eggs on the outside on the animal, generally on its hairy covering; the horse, by licking its own skin, or that of another horse, introduces the young larvae into its stomach or into its intestines, where, fastened to the walls, the larvae grow up and are finally expelled with the dejections. Once on the ground, they soon change into pupae, and then into flies. All these flies have a bee-like appearance, brownish and hairy (comp. Brauer's Monogr.

d. Oestriden, Vienna 1863, p. 53–90). The ordinary species, the common gad-fly of the horse, *Gastrophilus equi*, occurs in nearly all the parts of the old world and has followed civilisation into America and Australia. It is very probable that the ancients, ignorant as they were of the biology of *Gastrophilus*, and observing these flies swarm about horses, connected them with their notion about oxen-born bees, and as the honey-bee was already preoccupied by the ox, the brownish gad-fly was taken for a horse-born hornet.

But as the hornet is a kind of wasp, it happened later that the oxen-born *wasp* of the ancients (which, as I have shown, p. 9 and 15, is the fly *Helophilus)* became confused with the horse-born *hornet* (the fly *Gastrophilus)*, by people who spoke of them from mere hearsay, and not from actual observation. The ancients thus had:

1. The oxen-born bee — *Eristalis tenax*,

2. The oxen-, or horse-born wasp — *Helophilus*, both produced from rat-tailed larvae, occurring promiscuously in all kinds of stagnant and fetid waters;

3. The horse-born hornet — *Gastrophilus equi*, intimately connected with the horse, the larva living in its stomach, and therefore erroneously confused with the real carcase-born flies *Eristalis* and *Helophilus*.

To this *trio* of real, or pretended, carcase-born insects, a fourth companion is often added by ancient authors, a *beetle* (scarabaeus) issuing from the carcase of an ass. So in Pliny (XI, 20): „Virgilius juvencorum corpore exanimato. Sicut equorum vespas atque crabrones; sicut asinorum scarabaeos mutante natura ex aliis quaedam in alia.“ The same combination we meet in Plutarch (Cleomenes) and elsewhere. Modern authors have often referred to it; for instance Melanchthon in his allegory, reproduced below (in Supplem. VI), and Réaumur in the chapter which I have translated above, in my Supplement III. The beetle is probably the common black dung-beetle *(Geotrupes)*, but what connection it has with a dead ass, I do not attempt to explain.

I have already shown (p. 13) that Vallisnieri, who gave a particular attention to the study of *Oestridae*, had a presentiment about the connection of these flies with the craze of the Bugonia, but that he was mistaken when he thought that this explanation exhausted the subject. It was Réaumur (p. 9), who, by breeding *Eristalis* (his *mouche-abeille*), and *Helophilus* (his *mouche-guêpe*) from rat-tailed larvae, finally solved the problem.

But even before Vallisnieri (1661—1730), some authors seem to have had an inkling that some of the flies, swarming about domestic animals, do not issue from their carcases, but from their dejections. I have quoted (p. 43) a passage from the dictionary of Calepinus (1559), which contains the words: „apes ex bovum fimo, *sicut crabrones ex equorum*, fuci ex mulorum, vespae ex asinorum *excrementis*.“ The *crabrones ex equorum excrementis* answers exactly the view which I have just exposed, that the horse-born hornet (*crabro*) of the ancients corresponds to the common parasite of the horse, our gad-fly, *Gastrophilus equi*.

I believe that my explanation of the *imbroglio* between the horse-born hornet and *wasp* is the only possible, unless we cut the gordian knot by considering the whole of it as a mere craze, comparable with the spontaneous generation of a snake from the human spinal column (p. 25), but such an extreme course is not at all necessary.

VI.

The fable by Lessing (compare above, p. 25).

Die Wespen.

(Lessing's Fabeln I, 16) (1).

Hippos errhimenos sphecon genesis estin. Aelianus de natura animalium I, 28.

Fäulniss und Verwesung zerstörten das stolze Gebäu eines kriegerischen Rosses, das unter seinem kühnen Ritter erschossen worden. Die Ruinen des einen braucht die allezeit wirksame

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(1) Lessing's Werke. Stuttgart, Goschen'sche Verlagshandl., 1874. I. p. 116.

Natur zu dem Leben des andern. Und so flog auch ein Schwarm junger Wespen aus dem beschmeissten Aase hervor. O, riefen die Wespen, was für eines göttlichen Ursprungs sind wir! Das prächtige Ross, der Liebling Neptuns, ist unser Erzeuger!

Diese seltsame Prahlerei hörte der aufmerksame Fabeldichter, und dachte an die heutigen Italiener, die sich nichts geringers als Abkömmlinge der alten, unsterblichen Römer zu sein, einbilden, weil sie auf ihren Gräbern geboren worden.

(Translation.)

The Wasps.

The carcase of a horse produces wasps. Aelianus, de natura animalium I, 28.

Putrescence and decay have destroyed the proud stature of a war-horse, that was shot under its brave rider. Nature, always active, uses the decay of one for the growth of another. And thus it came that a swarm of young wasps emerged from the worm-eaten carcase. Oh, exclaimed the wasps are we not of divine origin! The beautiful horse, the favourite of Neptune is our progenitor!

This extravagant boast was overheard by the attentive fabulist, and at once it reminded him of the modern Italians, who believe themselves to be nothing less than the descendants of the immortal ancient Romans, for no better reason than that they were born on their graves.

The passage of Melanchthon, as reproduced by J. H. Voss, in his Commentaries to the German translation of the Georgics.

„Jene Erzeugung hielt übrigens noch der grosse Melanchthon für ausgemacht, und fand darin nicht nur einen Beweis der Vorsehung, sondern ein herrliches Bild der christlichen Kirche. Der erstickte und todgebläute Farr sei Christus, aus dessen Leichnam die Gläubigen mit der Predigt des Wortes hervorsummsen, angefeindet von zuchtlosen Rittersöhnen, als Wespen und Hornissen, von dem Eselgezücht der Pfaffen und Mönche, den unreinen Mistkäfern.“

VII.

Objections against my interpretation of the Bugonia of the ancients.

The only serious objection that may be urged against my identification of the oxen-born bee of the ancients with *Eristalis* (the *mouche-abeille* of Réaumur) is the fact that, in recent times, we have no instances on record of an *Eristalis* laying its eggs in the carcase of a large animal, except the single case, observed by Zetterstedt (p. 32). An eminent man of science, connected with one of the marine zoological stations, writes to me: „When, in our laboratory we have dissected some big animal, we are soon invaded by numerous *Calliphorae*, *Luciliae* and some *Sarcophagae*. We never saw an *Eristalis* among them, and yet, they frequently visit the outhouses of the laboratory, where the *Homalomyia scalaris*, *Scatopse notata* etc. also abound.“ My answer to this objection, will be found in the explanation which I have given of the habits of *Eristalis* in Suppl. I: „The larva of *Eristalis*, being aquatic, requires a pool of stagnant water containing putrescent organic matter. A carcase, left in the open air, is at once attacked by the ordinary carcase-loving flies *Lucilia*, *Calliphora* etc. During the second stage of putrescence a pool of corrupt liquid is formed about the carcase, and then is the time for *Eristalis* to appear.“ In the present age of sanitary police a carcase would never reach this stage, neither in a laboratory, nor in the open air. The only instance in point which I have discovered in the existing literature is the case of Zetterstedt, already quoted, which occurred in a distant and primitive country, Lapland. This single instance is the more instructive, as it was witnessed and described by a celebrated specialist in dipterology, who had no preoccupation whatever about the Bugonia, and merely related what he saw. The passage concerns the northern species, *Eristalis anthophorinus*, and I reproduce it in the Latin original accompanied by a translation:

„Ad cadaver ovis putridissimum, aquae stagnanti maximam partem immersum, odore foetidissimum, individua 7 vel 8 sono pipiente celerrime circumvolando congregantia, et in cadaveris parte supra aquam elevata interdum sedentia, die 16 Junii in Lapponia observavi, ova in cadavere sine dubio depositura.“

(*Translation.*) In Lapland, on the 16 of June, near a very putrid carcase of a sheep, the greater part of which was immersed in stagnant, most offensively smelling water, I perceived 7 or 8 specimens flying about in a circle rapidly, and emitting a piping sound, and sometimes alighting on the portion of the carcase above the water, evidently for the purpose of depositing their eggs.

Objectors may urge that the presence of the flies in this case was merely accidental; that they were hovering over the carcase, and settling upon it for rest, and not for oviposition. Fortunately, besides the testimony of the expert Zetterstedt, we possess another, more detailed description of the method of oviposition of an *Eristalis* by the master of patient observation and accurate description Réaumur (Mém. IV, p. 475). In Réaumur's case the egg is not deposited upon a carcase, but upon one of the tubs filled with stagnant water, which he kept in his garden for the sake of observing aquatic larvae. The preliminaries of the oviposition are described thus: „When the water does not reach the edge of the tub, and its surface is 8 or 10 inches lower, the fly, always on the wing, enters into the tub, and remains in it describing many circles just above the water; from time to time it dips the tip of its feet into the water; finally when this fly, ready for oviposition, has sufficiently examined the tub and the water, and ascertained that the place is suitable for its eggs, it alights on the inside wall of the tub, a few inches above the water. Then its begins to protrude its abdomen, the tip of which ends in a point bent towards the belly; it rubs this point against the wood; then it draws in the tip of the abdomen to make it protrude again very soon, and repeat the operation etc.“ The „describing many circles“ reproduces exactly the „celeriter circumvolando“ of Zetterstedt, and the fact that the eggs are deposited on the sides of the tub, and not dropped into the water, recalls the flies observed by Zetterstedt which settled upon the carcase, not merely for rest, but for the purpose of oviposition, as that author himself suggests it (1).

All observers know that the rat-tailed larvae of *Eristalis* are not at all particular in the choice of the medium for their development; what they require is water with a sufficient amount of decomposing animal or vegetable matter in it. „They occur in mire, particularly in fetid pools near stables, in kennels with a sediment of dirt, and other dirty places (Taschenberg, in Brehm's Thierleben IV, p. 468). Frisch found rat-tailed larvae of *Helophilus* in similar places, in pools of dung-water and in other fetid liquids (Frisch IV, p. 26, Tab. 13). The larvae of *Eristalis* are amphibious and are often found creeping about dirty and musty places. Letzner (Schl. Ber. 1856, p. 117), who found two larvae in such a place and bred one of them, did not even know that its natural habit was aquatic; he says: „lebt an modrigen, staubigen Orten und an Häusern (also im Trockenen)." Réaumur (IV, p. 440) says that he had often found rat-tailed larvae on dry land, long before he discovered, by a mere accident, a large number of them in the water. He says: „I had a glass-vessel emptied before me that contained water which I thought too fetid: many aquatic insects had perished in this water, and many tree-leaves had become rotten in it; its bottom was filled with a black and offensively-smelling mud . . . . . I perceived that it was teeming with worms, easily recognisable as rat-tailed larvae. We obtained from this mud more than two-hundred specimens." At the same time (p. 443) Réaumur adds: „The presence of such larvae in most offensively-smelling mud does not prove that such a medium is indispensable for them . . . I have found rat-tailed larvae which seemed to me of the same kind as the others in ordinary ponds, and I made them develop in tubs of water which had no bad smell.“

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(1) That Réaumur does not mention „the piping sound", produced by the flies in flying, was probably because he took the fact for obvious, as *Eristales* generally produce that noise in flying (comp. on p. 20 the observation of the Japanese author).

I have quoted (p. 36) an instance from New Zealand, at a wool-scouring etablishment, where hundreds of larvae of *Eristalis tenax* were observed swimming in fat-barrels, some of which had been standing for two years and were filled „with a thick, black, strong-smelling liquid; the larvae however appeared to thrive very well in this atrocious stuff.“

Finally, we have a dozen of well-authenticated instances of larvae of *Eristalis developing within the human intestines.* The best report of such a case was published by Dr. Balthasar Wagner in Fulda (Stett. Entom. Z. 1870, p. 78—80), when 3—5 larvae were voided, and from one of them *Eristalis arbustorum* was actually reared (1). It has not been ascertained yet how these larvae get into the human body. It seems probable however that they are swallowed, in the early stage of their development, with drinking-water. But it is nevertheless astonishing that they can reach maturity under such, for them extraordinary, circumstances.

I have given instances enough to show that rat-tailed larvae are not very fastidious in the choice of a medium for their development. They would certainly not object to pools of putrid liquid under carcases of animals, if opportunities were offered to them. Experiments might be tried, but in the matter of such experiments it should be borne in mind that they are conclusive only in case of success: a failure proves nothing, because we can never be sure of having fulfilled all the conditions required in nature. But instances may probably be met with, even in our days, in out-of-the-way localities, where there is no police to interfere with the natural decay of animals.

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(1) Other cases are reported by Spängenberg, Ent. Tidskr, Stockh. 1886, p. 121, in America by Prof. Riley, Proc. Ent. Soc. Wash. I, 4, p. 264 (1890); by J. A. Lintner, State Entomologist in Albany, N. Y. (*in litt.* to me), a case with a colored woman.

Hagen's Bibl. Ent. refers to: *J. Jacob d'Annone*, Acta Helv. 1760, T. IV, p. 301 – 306, Tab. I. I saw this paper in Prof. Westwood's library in Oxford. A woman, with great pain, voided a rat-tailed larva.

It may not be amiss here to quote the passage of Redi (Esperienze p. 56) where he says that J. B. Sperling, a very sagacious and zealous Zoologist, after visiting the seat of a great pestilence that had occurred in Württemberg among cattle, averred that he had never met there with a single case of the production of artificial bees (api fattizie). But Mr. Sperling may have been shrewd enough to distinguish an *Eristalis* from a bee: he may have seen many *Eristales* about the carcases, without recognizing in them oxen-born bees.

It remains for me to say a few words about Samson's story. Two propositions must be well understood in this connection:

1⁰. That, even should it be conclusively proved, that Samson's bees *had* built a comb inside of the lion's body (either in the state of a carcase or that of a skeleton), such proof would merely confute my interpretation of *this* case alone, and would not affect in the least my interpretation of the Bugonia of the ancients, which rests upon an entirely different set of arguments.

2⁰. That, for those who study the Holy Scriptures from the historical and literary point of view, my interpretation of the Bugonia affords a useful test of the truth of Samson's story: I mean to say, a proof that the story of the lion is not a mere myth, or the invention of a literate, but that it is based upon an actual occurrence, somewhat embellished, as often occurs, by the fancy of the narrator. The principal feature of the story is a natural phenomenon, related in all simplicity, but wrongly interpreted (for the true interpretation only came to be known some centuries later), and such a feature is *not* a subject for invention.

As for other arguments in favour of my interpretation of the story, I cannot do better than introduce here a translation of the article, published by Prof. Adalbert Merx in 1887, and of which I have already made mention (p. 18).

Professor Merx gives an account of the gradual progress made in the interpretation of the story. What he calls the „exegetic conscience“, could not accept the combination of bees with rottenness. From the old Syriac translator down to the learned and orthodox Jesuit interpreters of the XVIIth century, attempts were made to smooth over the difficulty. These attempts were of the weakest kind. A Hebrew word which undoubtedly means a corpse, they proposed to translate as „skeleton“; or they made a sophistical distinction between *urban* bees, fastidious and dainty, and *wild* bees, indifferent to bad smells. It is in our times only that a distinguished theologian, Studer in Berne, struck in the right direction in pointing out that the solution of the difficulty is to be looked for in Samson's riddle; a riddle presupposes the possibility of guessing it; it must be based upon some creed, or superstition, or notion of a kind understood and accepted by both parties; the problem consisted therefore in the discovery of this *substratum*, or key, to the riddle. This was found in the recognition of the fact that Samson's bee was in reality a carcase-born fly, looking very much like a bee, and which had given occasion to the superstition about carcase-born bees. Such is the substance of Professsor Merx's able and learned article.

VIII.

The Honey in the Carcase of the Lion.

By A. Merx (1).

Since friend Siegfried (2) has let out the secret that conscientious expounders of the scriptures are driven to despair by the milk-and-honey-question in Isaiah, Chapt. 7—9, without his being able to help them out of the difficulty, I feel impelled to call attention to another passage, where honey appears in a strange combination. I mean Judges 14. 8, where it is said that bees and honey were found in the carcase of a lion, a place which evidently was not calculated to improve the flavour of the honey. Luther's translation has: „carcase of a lion.“ The „Probe-Bibel“ (1) amended it into „a body“ (Leib) of a lion, which did not remove the difficulty. In this case the „Probe-Bibel“ has attempted to smooth over a knotty point which had been a puzzle, and an excuse for incredulity, for a very long time. The difficulty had to be overcome at any price, and two separate ways have been tried in order to effect this. Some have followed both ways simultaneously.

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(1) This is a translation of Prof. Merx's article in German, which appeared in the „Protestantische Kirchenzeitung“ 1887, p. 17. Compare my remarks about it at the end of the preceding Supplement. A. Merx is Professor of Scriptural Exegesis in Heidelberg.

(2) Siegfried is Professor of Theology in Jena.

The one way is taken by the old Syriac translation, which, instead of *body* or *carcase* (*mappelet* and *gewiijja* in hebrew) uses the word *skeleton*. Supposing a clean and bleached skeleton, we can easily imagine that a swarm of bees might settle within it, although the building of combs under such circumstances would require an expenditure of wax greater than usual. But, as the transformation of a carcase into a skeleton requires a good deal of time, it seemed evident that the interval between the killing of the lion and the return of Samson to it, on his way to his bride, should be equally long. So whilst verse 8 says distinctly „and he came back in a few days“, as Luther correctly translated it, some expounders, in the interest of the their carcase-theory, have changed the „few days“ into a whole year. So, for instance did Levi ben Gerson, who says in a note: „Samson returned a year after, to marry the woman; it seems that twelve months had been granted her for her preparations“ (2).

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(1) The „Probe-Bibel“ is a German translation of the Bible with merely tentative corrections of Luther's version, intended to elicit amendements and criticisms. The first edition was published in Halle 1883, and is commonly called „die sogenannte Probebibel“.

(2) Twelve months is a much longer interval than is usually granted, by the Hebrew Law, to a bride between the engagement and the marriage. (Remark by Prof. Merx.)

Other writers may also have adopted this opinion, which Studer (1) has discussed in his commentary, referring to Selden's *Uxor hebraica* II. 8. A modification of the skeleton-theory, and a truly foolish one, was that of Rosenmüller: that the carcase may have been mummified in a short time by the hot sun; he does not take into account the foxes and jackals, as Bertheau does, in order to clean the skeleton more swiftly. Had the Jewish teachers thought of this, they would surely not have made a whole „year" out of a „few days". At any rate, the word „mappelet" used in this instance, means literally *carcase*, and it is altogether improbable that a *skeleton* was meant by it. Finally, in support of this skeleton-theory a passage of Herodotus V. 114, is quoted, the story of the beheaded Onesilos, whose head was hung up by the Amathusians upon the city-gate. and having, in the course of time, become hollow, was occupied by bees with their honey-combs. The occurrence cannot have been a common one, because the Amathusians consulted an oracle about it, whose answer was that they should bury the skull, and render divine honors to Onesilos. They followed this bidding, and Herodotus found, at his time, the custom still honoured among them.

Now any one can easily understand that bees might perhaps build in a hollow skull, which for them would differ but little from a wooden box, but not in the belly of a skeleton, which, after all, has no belly. Strange is the assumption of the Septuaginta, that the bees had built in the *jaws* of the lion, as if to give force to the expression: „out of the strong came forth sweetness".

The interpretation of the word *mappelet* by „skeleton", in all these instances, has evidently no other purpose than to provide a means of escape from the improbability of bees hiving in a carcase, as it is well known that bees do not like bad smells, and that nobody as yet has found honey in a carcase. The learned men knew from Aristotle's „Historia animalium"

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(1) Studer was a Professor in Berne. (Das Buch der Richter erklärt, Bern 1835.)

(edit. Bekker, I, 626*a*), and the peasants of Syria had ascertained by experience, that living bees eject the dead ones from the hives, that they are very cleanly, and that they even emit their dejections in flying (627*a*, 11). With a knowledge of these facts, the Syrian translator changed the „carcase" into a „skeleton", although it is difficult to understand why bees should live in a skeleton (1).

This was *one* of the ways resorted to in order to remove the difficulty.

The exegetic conscience, however, was not quite satisfied with this expedient. It would be a grand thing to be able to save the credit of the narrative by proving that bees, in some cases, *do* get at „carcases", and so be rid of the objectionable skeleton! According to Polus (2), it was the Jesuit Lorinus of Avignon (1559—1634), and even before him Alphons Tostatus, Bishop of Avila († 1454), who came to the rescue with the easy remedy of a *distinguendum est*. The *urban* bees are well-educated, and therefore cleanly, but the *wild* bees are much less fastidious. Another Jesuit, however, Bonfrère (1573—1643) declares this to be pure sophistry, for which no good authority could be found. But we have to take note of it here for a particular reason, which I shall presently explain.

In view of these attempts at interpretation it must be borne in mind that the ancients believed bees to originate from carcases, like the fleas bred by spontaneous generation, according to the utterance of the carrier in Shakespeare's Henry IV, Pt. I:

> Your chamber-lie breeds fleas like a loach (3),

where loach is meant for a small prolific fish.

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(1) The statement of Aristotle passed also into the Latin literature, the cleanliness of bees being known to Columella 9, 5 and to Pliny, N. H., 11, 21, as Polus says in his *Synopsis Criticorum* (Merx).

(2) Polus, Matth. a non-conformist preacher in London, who was obliged to leave England under Charles II, and died in Amsterdam in 1679. He published a *Synopsis Criticorum*, a compilation of all exegetes of the Scriptures, and other works (Jöcher, Gelehrtenlexicon).

(3) The translator into German, Schlegel, renders this passage: breeds fleas like the spawn of a frog. *Loach* etymologically is related to the German

The passages of authors who make mention of this belief have been collected by Bochart (Hierozoicon), and, among them, the following:

Antigonus (Mirabilium historia, 23) says that, when an ox is buried so that the horns protrude, and these are sawn off, bees escape therefrom, the rotting ox being converted into bees.

Varro (de re rustica II, 5 and III, 16) observes that bees orginate in part from other bees, in part from rotten oxen. The same is repeated by Columella (9, 14), also by Democritus, Mago, and Philo who mentions it as a popular notion (De victimis offerentibus § 6). Likewise by Pliny, N. H. XI, 20, Plutarch in Cleomenes, Aelian II, 57; Galen (An animal sit quod in utero geritur, edit. Kühn, XIX, 5, p. 175), Origenes (Contra Celsum IV, 57) (1), Florentinus (Geoponica, XV) etc.

The frequent mention of it in poetry also proves that it was a well-known popular belief: Ovid (Metam. XV, 365), and Virgil (Georg. IV). It was owing to this belief that bees were called oxen-born, *bugenès.*

From such passages it was concluded that the dislike of bees for carcases might be subject to exception, that a tolerably clean skeleton, and less fastidious bees, might be reconciled with the verisimilitude of the story of Samson, the more so as the text says nothing about the origin of the bees. Such was the resource of Lorinus and of Tostatus, who distinguished two kinds of bees, and of Bochart, on whose erudition his successors have subsisted, so that even Polus borrowed from him the reference to Soranus's „Vita Hippocratis“, containing the story of Hippocrates's Mausoleum: bees founded a colony in it, for which undertaking they had had plenty of time, because

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Laich (spawn), just as the English *loaf* to the German *Laib*, *hoarse* to *heiser* etc. (Merx).

(1) Origenes, in this passage, uses the transformation of carcases into insects as an argument in favor of the doctrine of the immortality of the soul. He takes advantage of all the phenomena observed on decaying bodies, including the transformation of the spinal marrow into a snake. Compare, as typical, the interpretation of Ephraim at the end of this paper (Merx).

Soranus lived about 100 B. C., while Hippocrates died about 350 B. C. After that, it was superfluous to relate a similar case of bees in a funeral vault in Verona (1566), which Polus also borrows from Bochart.

With Studer begins a better understanding of the story. He is of the opinion that, if we admit in Samson's story the influence of a popular creative tradition, we may also allow that, in the imagination of the story-teller, the bees were actually generated from the rotting carcase of the lion! This assumption seems the more plausible, as it agrees exactly with the wording of the riddle: „And out of the strong came forth sweetness", and, as it tallies with the requirement of a riddle, that its solution should be possible in so far as it is dependent on some notion familiar to both parties. It should be some natural phenomenon believed to be possible, and which the people concerned were expected to guess from the obscure wording of the riddle. With this train of thought, Studer connects the references of Bochart with the remarks of JAKOB to the passage in Aelian II, 57 of BARKER, Ep. Critic. p. 228, and of DEDEKINDUS in *Horreo,* Hannover 1822.

About the last of these papers, which I am not acquainted with, Studer says that its object is to inquire into the source of such a superstition, and it is the very object of the present lines to point out this source. The superstition owes its origin to the confusion of the honey-bee with a carcase-fly, *Eristalis tenax,* which is so like the bee, and especially the stingless drone, that non-entomologists do not easily distinguish them (1). The larvae of *Eristalis tenax* develop in water, charged with putrescent organic matter, and accumulated in drains, around dunghills, or carcases. If we do not see them about carcases often at present, it is because sanitary police regulations have made it impossible. As the fly is remarkably like a bee, Baron Osten Sacken is perfectly right in supposing that the antique superstition about the origin of bees from rotten carcases is solely due to the confusion between the bee and the fly *Eristalis tenax*. His paper in „The Entomologists Monthly Magazine“ XXIII, p. 98, 1886, gave occasion to the present publication.

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(1) All the persons to whom I showed the specimens of *E. tenax* at once recognized bees in them, except a medical man, who had some knowledge of entomology. A stingless bee in Abyssinia, mentioned in Ludolf, Hist. aethiop. I, 13, 25 may possibly be an *E. tenax* (Merx).

This belief is therefore the foundation of Samson's story; the riddle assumes that an answer to the question which it puts is possible for those to whom it is put. And when Samson says:

> Out of the eater came forth meat
> And out of the strong came forth sweetness,

and the other party answers by another question:

> What is sweeter than honey?
> And what is stronger than the lion?

it shows that both parties agree in the belief that honey-bees are produced from carcases. Such an agreement, founded on a popular superstition, is the *conditio sine quâ non* of this game of riddles, and, without it, the riddle would be insoluble.

After this explanation, what shall we say of the old expounders, one of whom, Polus, declares that he ascribes the miracle to the divine Providence which meant to offer Samson an occasion for attacking the Philistines; and another, Ephraim the Syriac, (Carmina Nisibena 39, 210) who sees in it a type of Christ, and puts the following speech in the mouth of a personification of Death: „Samson found a honey-comb in a carcase! But what means this type?! Jesus offers so many types; I have fallen into a sea of types which represent the Resurrection from the dead in all kind of images and figures. Samson symbolises: Out of the eater came forth meat; with me it is just the contrary; he who was my food, became my eater, because from Adam came the son of Man, who puts an end to me!“

IX.

A new hypothesis about the origin of the Bugonia-superstition.

Professor A. Giard, in Paris, kindly communicated to me an article by Mr. F. Lahille, which appeared in the periodical „Le Naturaliste", Paris, 15th August 1891, p. 198—199, and is entitled; *Le rôle du foie chez les Anciens. — Allégorie d'Aristée.* The purpose of this article is to show that the sugar-excreting (glycogenic) function of the liver, discovered by Claude Bernard, was known to bees and wasps long ago („peut-être bien avant l'apparition de l'homme sur la terre"), and that the ancients, having made this observation, used to attract bees by the exposure of the liver of dead animals, and thus to feed them during unfavorable seasons, when flowers were scanty. „The ancients had noticed, says Lahille, that during bad seasons, bees were fond of alighting on the liver of dead animals, but they went beyond the limits of observation when they assumed that honey-bees were bred in the substance itself of the liver. Virgil did not perhaps admit these ideas of spontaneous generation, and his aim may have been merely to prove that a learned man is the master of nature, and that he can produce life from death. The great poet attributes to the Egyptians the discovery which he announces, and this is a confirmation of the authenticity of the fact, and of the explanation which I offer of the allegory of Aristaeus." (1)

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(1) „Les anciens avaient donc remarqué que dans les mauvaises saisons les abeilles se posent de préférence sur les foies des animaux, mais là où ils dépassaient les limites de l'observation, c'est lorsqu'ils croyaient que les mouches à miel naissent de la substance même du foie. Virgile peut-être n'admettait point ces idées de génération spontanée et a-t-il voulu simplement indiquer que le savant est le maitre de la nature et qu'il sait tirer la vie de la mort. Le grand poète attribue aux Egyptiens la découverte qu'il signale et c'est une confirmation de l'authenticité du fait et de l'explication que je propose de l'allégorie d'Aristée" (p. 199, first column, near the bottom).

It is beyond my competence to discuss the glycogenic properties of the liver and their attractiveness for bees and wasps. I shall merely state the difference between Lahille's hypothesis and mine. His theory does not explain the persistent efforts of the ancients, during centuries, to obtain oxen-born bees from carcases. He occupies the old standpoint of commentators and translators who merely derided the stories about such efforts, although they could not deny that they had actually taken place. My attempt on the contrary was to prove that the oxen-born bee and wasp of the ancients are the same as the „mouche-abeille“ (*Eristalis*) and „guêpe-abeille“ (*Helophilus*) of Réaumur, and I have shown, by a detailed analysis of the process used at that time, that the ancients had discovered the best possible manipulation for the purpose of obtaining just these flies, and no others. In the numerous mentions of the Bugonia among ancient authors (Greek or Latin), it is always brought in in connection with rottenness and carcases. The association of honey-bees, cleanly animals, with rottenness is out of the question; when they are attracted by meat, or sugar-bearing liver, it is by fresh meat and sweet liver. In attempting to adapt the myth of Aristaeus to his theory, Mr. Lahille most palpably misunderstands the true sense of Virgil. He says: „Aristaeus chooses eight young herbivores, eight splendid beasts. He immolates them near a wood; the entrails are left open, and, some time afterwards the bees, more and more numerous, alight upon the liver to suck the accumulated sugary matter; they even make the branches of the trees bend under their weight.“

Virgil distinctly says that the bees emerged from *within* the carcase, and did not come from *without;* and he does not say that the entrails were left in the open air. In my Suppl. I I have given a detailed account of the episode in Virgil and I refer to it. The above-quoted passage of Lahille is not a rendering of verses 550—559, which sum up the episode and describe the rush of the swarm from *within* the carcase:

. . . . liquefacta boum per viscera toto
Stridere apes utero et ruptis effervere costis.

X.

Notices on some of the authors whose works contain mentions of the Bugonia, and who have been quoted by Redi, as well as, in the present publication, with references to Redi.

Aelianus, Claudius, lived in Rome at the time of Heliogabalus; his „Historia animalium“ is written in Greek. Passages from this work are quoted on p. 1 and 25.

Antigonus, called *Carystius*, from his birth-place Carystus.

„Antigonus is supposed by some to have lived in the reign of Ptolemaeus Philadelphus (309—247 B. C.), and by others in that of his son and successor, Evergetes. Respecting his life nothing is known; but we possess by him a work called: „historion paradoxon synagoge“ (Historiae Mirabiles) which consists for the most part of extracts from the „Auscultationes“ attributed to Aristotle, and from similar works of Callimachus, Timaeus and others, which are now lost. It is only the circumstance that he has thus preserved extracts from other and better works, that gives any value to this compilation of strange stories, which is evidently made without skill or judgment.“ (Wm. Smith, Dict. etc. sub voce *Antigonus.*) His passages about the Bugonia are quoted on p. 7, 21 and 24.

Archelaus. A greek poet, about whom very little is known comp. W. Smith, Dict. etc. sub voce *Archelaus*, Vol. I, p. 264: „Westerman has shown that Archelaus in all probability flourished under *Ptolemy Philadelphus* (309 - 247 B. C.), to whom, according to Antigonus Carystius, he narrated wonderful stories (*paradoxa*) in epigrams.“ Georges, Latin-German Dictionary, under *Bugonia* refers to Archelaus as author of a work on the *Bugonia*, and quotes Varro, de Re Rustica II, 5, 5. This passage in Varro (evidently a corrupt one) speaks of the „author of the *Bugonia*“, without naming him (comp. p. 21 foot-note).

Cardanus, Hieronymus (1501—1576), in Pavia. De subtilitate libri XXI. 1550. In the Heidelberg University-Library I found a later edition, published in Bale, in which, in book IX, entitled: „de animalibus quae ex putredine generantur“, I found the following passage:

„Sed his relictis, ad apum genus revertamur. Gignuntur propagatione, ex putredine non omnium, sed boum, ut ex equis vespae, ex asinis fuci, et crabrones ex mulis; quare videntur singula cum putrescunt animalia genus quoddam proprium generare.“

A somewhat premature generalization! Scaliger's criticism, quoted by me in Suppl. XI, evidently refers to this passage.

Celsus, Cornelius, „a very celebrated writer on medicine, of whose age, origin, or even actual profession, we know but little“. Only one of his numerous works has come down to us, „*De Medicinâ*“, in eight books. He lived about the beginning of the Christian era (W. Smith, Diction.). He is quoted, together with Columella on p. 6.

Columella, L. Junius Moderatus, from Cadix in Spain, lived under Tiberius and Claudius. The only work now extant is his „*De re rusticâ*“ in twelve books. The passage, Book IX, 14, quoted by Redi (comp. above, p. 6), reads as follows:

After explaining what is to be done with hive-bees at different seasons, Columella continues:

„Caeterum hoc eodem tempore (Caniculae) progenerari posse apes juvenco perempto, Democritus et Mago, nec minus Virgilius prodiderunt. Mago quidem ventribus etiam bubulis idem fieri affirmat. Quam rationem diligentius prosequi supervacuum puto, conveniens Celso, qui prudentissime ait, non tanto interitu pecus istud amitti, ut sic requirendum sit.“

(*Translation.*) It is about this time of the year (the dog-days) that, according to Democritus and Mago, as well as to Virgil, bees can be produced from a slaughtered young bullock. Mago affirms that the paunch of the bullock is sufficient for the purpose. I think it unnecessary to go further into the matter, agreeing as I do with Celsus, who wisely remarks, that the mortality amongst bees is not such as to warrant the experiment.

J. H. Voss (p. 277) renders the sense of this passage as follows:

„Celsus hatte nur den vernünftigen Einwurf, wie Columella ihn nennt, die Kosten der Erzeugung seien zu gross.“

Lenz, H. O., Zool. der Griechen und Römer, Gotha 1856, p. 595, has a different version:

„Columella bemerkt, dass Democritus, Mago und Virgil die genannte Erzeugung der Bienen lehren, pflichtet jedoch dem Celsus bei, der wohlweislich behauptet, die Kunst aus todgeschlagenem Rindvieh Bienen zu machen, bringe mehr Schaden als Nutzen.“

Democritus, quoted by Columella together with Mago (see Columella), is not the philosopher of that name. Voss (p. 280) calls him the *false* Democritus. I do not find any mention of him either in W. Smith, Diction., or in Jöcher's Gelehrtenlexicon.

Florentinus. „A Byzantine writer of uncertain age, but who lived in, or before, the tenth century A. D.“ (W. Smith, Diction. etc.) About him comp. the List of Authorities, under *Geoponica.*

Horus (whom Redi calls „Oro“) I find in W. Smith, Dictionary etc. under *Horapollo:* „Under the name of *Horapollo* (or as some erroneously call him Horus) there is still extant a work in two books on hieroglyphics etc.“ He lived about the 5th century A. D.. Redi says (comp. above, p. 24) „Horus, in the 23rd Chapter of the second book on hieroglyphics speaks of wasps, issuing from the flesh of crocodiles etc.“ W. Smith's Dict. etc. says: „The second book is inferior to the first, and is probably disfigured by later interpolations.“

Lando, Hortensius, a physician in the 16th century in Milan, wrote a *Dialogue against Erasmus,* under the pseudonym of „Philalethes utopiensis“, and different other works on various subjects: Commentario delle più notabili et monstruose cose d'Italia; Paradossi; Sermoni funerali delle bestie. A recent work about him by Irineo Sanesi, appeared under the title: „Il cinquecentista Ortensio Lando (Pistoja 1893, Fratelli Bracalli). — According to Redi (comp. p. 24), Lando contended that „hornets originate from the brain of asses.“

Mago, an old author on Agriculture, who lived in Carthage, was much esteemed, even by the Romans after the destruction of Carthage (comp. W. Smith, Dict.). Comp. above, Columella, who quotes him.

Moufet, Thomas, was a contemporary of Queen Elisabeth, and died without publishing his work. „It fell into the hands of Sir Theod. Mayerne, Baron d'Aubone, one of the court physicians in the time of Charles I, who, at length, published it, prefixing a dedication to Sir Wm. Paddy M. D., in 1634.“ (This passage, as well as the previous history of the „Theatrum Insectorum“ will be found in Kirby and Spence, Introd. IV, p. 429—430). I spell MOUFET (K. and S. have MOUFFET) as I find it on the title-page of my copy of the „Theatrum“, 1634. By a strange, and perhaps significant coincidence, such works as Moufet's, Swammerdam's, and Lyonet's „Recherches“, were neglected by their contemporaries, and published long after the death of their authors. Ray's „History of Insects“ was not published until six years after his death. An incident in Ray's life serves to illustrate the utter contempt in which entomological studies were held at that time. „Early in the 18th century an attempt was made to set aside Lady Glanville's will on account of lunacy, evinced by no other act than her fondness for collecting insects. It is on record that her friend Mr. Ray, the eminent naturalist, had to appear at Exeter on the trial as a witness of her sanity.“ („A group of Naturalists“, article by Mrs. Andrew Crosse, in „Temple Bar“, July 1893.)

MIEDIS. Bernardinus Gomez Miedes (or Miedis), a Spaniard from Alcanizio in Aragon, lived for a long time in Rome, travelled later in France, Holland, and Germany, became Archdeacon in Murviedro, and finally Bishop of Albarazzin in Aragon. He published: Diascepses de sale physico, medico, geniali et mystico, printed in Valentia 1572 and 1579; also a work: De Constantiâ, and a Life of James I, King of Aragon, 1584. Miedis died 1589. (Jöcher's Gelehrtenlex., Leipzig 1733.) Comp. p. 27.

NICANDER. Greek poet of the 2nd century B. C,; his principal poem, called „*Theriaca*“, consists of a thousand hexameters and treats of venomous animals and the wounds inflicted by them. Haller (*Bibl. Botan.*) calls it „longa, incondita et nullius fidei farrago“ (Smith, Dict.).

Bochart translates a passage from Theriaca, v. 741 thus: „Discerpti enim a lupis equi vespas, tauri apes, corporibus corruptis, progenerantur.“ Comp. p. 24, line 14 from bottom.

ORIGENES (186—253 A. D.) in Egypt. Celebrated Christian writer. In his work: Contra Celsum, IV, occurs the following passage on the Bugonia, which I quote after Bochart: „Cum non miremur etiam nunc ex homine mortuo serpentem fieri, e dorsi medulla, ut quidem aiunt; et ex bove apem, ex equo vespam, ex asino scarabaeum.“ About this passage, comp. above, p. 66, foot-note.

Olympiodorus. Many literary personages of this name are mentioned in W. Smith's Dict. etc. The one quoted by Redi is probably the Olympiodorus who is mentioned by Pliny amongst „those writers from whom he drew materials for this XIIth book“. Redi mentions him among those authors who assert that the dead ass produces drones and beetles, but not wasps (compare p. 24).

Pachymeres, Georgius (1242; died after 1310), one of the most important among the later Byzantine writers. — *Historia Byzantina* (History of Michael Palaeologus) etc. Pachymeres, according to Redi (comp. p. 24), asserts that wasps originate „neither from the flesh, nor from the skin“ of animals, but from the brain. I have examined his *Historia*, but have not found any statement of that kind. It may perhaps be found in another work of his, his *Commentaries on Aristotle*, which I have not compared, and it may refer to the *Oestrus ovis*, which develops in the brain of sheep.

Philetas, Grammarian and poet from Cos; 3rd cent. B. C.; lived in Egypt: quoted by Antigonus. Bochart quotes the passage (translated from the Greek): Taurigenas haec fatus apes longinquus adisti. Redi mentions him, Esper. p. 55.

Philo, called Philo the Jew, to distinguish him from other authors of his name. Lived in the first century A. D.. Student and imitator of Plato. Bochart has the following passage by him (translated into Latin):

„Apis impurum est animal, quodque ex mortuorum boum putredine et corruptione nasci aiunt.“ Redi (Esp. p. 56) quotes his „treatise on sacrificed animals“ (De victimis offerentibus) from which the preceding passage is probably borrowed.

Philo from Tarsus alludes to oxen-born bees „nella descrizione del suo famosissimo antidoto“, says Redi (Esp. p. 55); I do not know this author.

Porta, Simon, or Portius (1497—1554), Neapolitan, Professor of Philosophy in Pisa for some time; began a history of fishes, which remained unfinished. He did not believe in the immortality of the soul (Jöcher, Gelehrtenlexicon). Porta (compare above, p. 24) is among those who, according to Redi, asserts that the dead ass produces drones and beetles, but not wasps. — I have not been able to verify this statement.

Servius Honoratus, called Grammaticus, lived in the beginning of the 5th Century A. D. Wrote a commentary on Virgil. Bochart quotes the following passage (Redi, comp. above, p. 24):

„Apum sunt multa genera. Proprie tamen vocantur apes de bobus, fuci de equis, crabrones de mulis, vespae de asinis.“

Varro, M. Terentius (116—28 B. C.). Contemporary and friend of Cicero. Was called „the most learned of the Romans“, and composed, according to his own assertion (Gell. III, 10) *four hundred* and *ninety* books. It is remarkable that only one of his works has descended to us entire: „*De re rusticâ*“, in three books, from which we have quoted passages on p. 2, 21, 22. (For details comp. W. Smith, Dict. etc.)

About the corrupt passage from Varro, II, 5 (quoted above, on p. 22, footnote), I find in Forcellini's Lat. Dict. (De Vit, 1858—60) under *Bugonia*, the following statement: „Est autem hoc nomine carmen ludicrum incerti cujusdam poetae, et parodia, ut videtur, Theogoniae, cujus meminit Varro.“

XI.

Notice on Pastor Overbeck's paper on the Bugonia (1745).

I conclude the series of my Supplements by a curious composition, which was pointed out to me by Professor Zangemeister, Director of the Library of the University of Heidelberg. It is a rather clever sarcastic parody of the attempts of certain theologians, at the end of the seventeenth century (Dom Calmet, Huet, Sam. Bochart etc.), to explain the myths of the ancient heathen mythology by reference to the Holy Scriptures, and to prove that the personages of the old poets, were mere travesties of the heroes of the Old Testament. This curious paper deserves to find a place in the history of the Bugonia.

Overbeck, J. A., Pastor adjunctus zu Handorf. — Gedanken von der *Bugonia* der Alten (1). In the „Hamburger Vermischte Bibliothek", Vol. III, p. 352—361; 1745).

As the title implies, this article contains a short account of the Bugonia-superstition of the ancients, with references to Varro and other sources. The author observes that the general belief of the ancients in the *generatio aequivoca* may serve as an excuse for such a craze on their part, but that this excuse cannot be used in favour of writers of such eminence as Aldrovandi and Joh. Johnston (in his work De Insectis); they should have at least made experiments before presuming to instruct the world about that absurd method of breeding bees. As an example for them to imitate, he quotes the learned Julius Caesar Scaliger (Contra Cardanum), who, a century before them, had denied the possibility of the Bugonia (2). Overbeck likewise

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(1) „Thoughts on the Bugonia of the Ancients." I received the volume of the Hamb. Verm. Bibl. from the Grand Ducal Library in Carlsruhe.

(2) J. C. SCALIGER, Exercitationes; de Subtilitate, ad Hieron. Cardanum. 1565. Frankfort o. M. I have consulted this work in the Heidelberg University Library, and give the result here:

Exercitatio 190, 2 (not 90, as Overbeck quotes it) contains the following passage: „Sed et adversum veritati illud est: ex quocunque animali putrefacto progigni aliquid animatum. Si enim verum esset, subiret sese circularis generatio; ut ad primum, unde factus esset motus, tandem reverterentur.

Si vitulo apes, ex ape vermiculus, ex vermiculo aliquid; ex eo aliud porro proveniret: fieret necessario, ut vel ad vitulum rediretur aliquando, vel procederetur in infinitum. Quamobrem non erit, quod ais, verum: è singulis, cum putrescunt, aliquid proprium generari."

This criticism evidently refers to the passage of CARDANUS which I have quoted in the Supplement X, and is quite pertinent. But its weight is somewhat impaired by the following characteristic passage about Scaliger in the Cyclop. Britann. 1886 (in the article on this author by R. Christie): „We are astonished at the encyclopaedic knowledge which the Exercitationes display, but we are obliged to agree with Naudé that Scaliger has committed more faults than he has discovered in Cardanus, and with Nizard, that his object seems to criticises the opinion of Athanasius Kircher (in his works: *Obeliscus* and *Oedipus*), who contends that the hieroglyphic image of an ox, with a bee between its horns, implies an allusion to a regal origin. Overbeck remarks that this image may, just as well, have symbolized the fecundity of Egypt, „milk and honey" being a common oriental expression in describing abundance. Bernh. Gomez (who is no other than B. G. Miedis, comp. above, p. 27 and 74) is also referred to, but his reasoning about the connection between bees and oxen is ridiculed in the remark that „our bee-keepers might, with just as much reason, attempt to justify the presence and usefulness of a caste of nobility among men by the example of the drones in a bee-hive".

Overbeck concludes his article by a serio-comical attempt at deriving the myth of Aristaeus from the story of Samson. I reproduce only the principal portions of his argument. The necessary references from the Book of Judges, are supplied by me.

„It is not easy to explain", says Overbeck, „how it happened that Aristaeus has been mixed up with the story of the Bugonia; but, as soon as we admit the very plausible theory adopted by many learned men (1), that several of the fables of Greek poets have no other foundation than the misunderstanding of some passages of the Holy Scriptures, which they are said to have read, we may also admit the hypothesis that under the personage of Aristaeus is hidden the celebrated Samson of the Bible. Let us attempt a detailed comparison between

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be to deny all that Cardanus affirms, and to affirm all that Cardanus denies." That Scaliger *was*, however, an observer of living nature is clear from several of his passages; I have found for instance the following, which will be understood by dipterologists: „Tyro cum essem, e grandioribus muscis unam albis pictam lineis specie illectus cepi. Et in volà manus aliquandiu retenta pluscuios edidit vermiculos candidos, mobilitate propria insignes" (Exert. 191, 2). This is a correct observation on the viviparous fly *Sarcophaga*.

(1) Overbeck refers here principally to DOM AUGUSTIN CALMET'S Biblical researches, to PIERRE DANIEL HUET'S: Demonstratio evangelica (1679), and also to our friend SAMUEL BOCHART.

these two heroes. Samson is, as every body knows, the person who, according to the Holy Scriptures, found a swarm of bees in the carcase of a lion he had killed. The same story is told about Aristaeus, but with an alteration, not uncommon with fables of this class, which substitutes the carcase of an ox for that of a lion."

„Read Virgil and do not be influenced by some collateral issues in his account (1), because nothing is better understood than that the heathen, with their mythology, have tarnished and disgraced the great deeds of many celebrated heroes. Although Aristaeus himself is not reported to have killed a lion, this deed is ascribed to his mother, who is said to have strangled such an animal, upon the head of which King Eurypilus had set the price of a kingdom. — The name of Aristaeus is derived from the power of his speech; under this guise is hidden the strength of Samson. The father of Aristaeus has less right to be called „the sun", than has the name of Samson to be rendered as the „man of the sun" (der Sonnenmann) in our language. The fine head of hair, attributed to Aristaeus, as well as to his father, can be interpreted with very good reason, as meaning the hair of the Nazirite Samson, which was parted into seven locks (Judges, 16, 14. R. V.). *Zorah*, in Palestine (Judges 13, 2) was Samson's birthplace; but the fable misunderstands this fact and calls his mother by a somewhat similar name, *Cyrene.* Aristaeus is said to have lived in a cavern in Euboea. Is that not the „cleft of the rock Etam", where Samson dwelt? (Judges 15, 8.) Aristaeus lived as a shepherd on the fields, and was for this reason called *agrius* and *nomius;* so I cannot imagine the life of Samson otherwise than like that of a shepherd, who also had his herd. Aristaeus's principal food was milk and honey, the invention of which is ascribed to him; Samson being a Nazirite (Judges 16, 17), was forbidden from drinking wine, and therefore needed nutritious food, and so we see in the Book of Judges (14, 9), that he gave his parents a honey-comb to eat. Aristaeus was a cultivator and lover of olive-trees; but such trees were also common enough in the Holy Land, and Samson, being a wrestler, must have often rubbed his body with olive-oil. Aristaeus was known as a wise man and a good king. Samson, for twenty years, showed great wisdom in „judging“ Israel. Aristaeus was, for some time, under the care of nymphs and other aquatic divinities. I dare say this fable was aimed at Samson's love-affair in the valley of the Sorek (Judges 16, 4) with the woman whose name was Delilah (*deli* in hebrew means a pail of water). We may observe that, in the story of Aristaeus, a fire broke out on the island Cea, during the dog-days, the heat of the sun setting fire to the crops; in this case, it seems to me, the dog-star is the same as Samson's foxes, with which he set fire to the fields of the Philistines. From a surname of Aristaeus, who was called PHERECIDES, by a slight alteration, we obtain the surname of Samson „fereoikos“, „domiporta“, from his having carried off the gates of Gaza. The tanner's shop in which Aristaeus is said to have perished, may have been the very house of the Philistines, the collapse of which was the end of Samson's heroic career.“

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(1) Should we, for instance, apply Virgils account of Proteus to Samson himself, it would be an easy matter adroitly to refer the account of Proteus's castle, and his being thrown into fetters (Georg. IV, 396—414), to Samson's adventure with Delilah.

„Such is the comparison of Samson with Aristaeus. In this instance, we have neither expected, nor, as we are aware, succeeded, in bringing historical credibility up to the level of certainty. If we have introduced ill-grounded suppositions, and thus deserved blame, we have the excuse of such authorities as a CALMET, a HUET, and a BOCHART, and I do not know how many other great scientists, who have done the same before us. A precedent, in such cases, may serve as a sufficient justification!“

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